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TECHNICAL REPORT 4901

BLAST PARAMETERS OF M26EI PROPELLANT

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PICATINNY ARSENAL
PROJECT COORDINATOR

DECEMBER 1976

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PICATINNY ARSENAL
DOVER, NEW JERSEY

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Experiments were performed with M26E1 propellant, multiperforated, 0.038 inch web size, in subscale and full-scale shipping drum, dryer, and blender configurations to determine the airblast pressure and positive impulse resulting from the detonating material. Variables considered included propellant weight, booster size, and configuration. Peak pressure and positive impulse were measured in the over

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APPROXINATELLY EQUAL TO

scaled distance range of ≈ 3 to $40 ft/lb^{1/3}$. TNT equivalency curves for both pressure and impulse were developed as a function of scaled range.

40FT PER lb TO THE ONE THIRD POWER

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ACKNOWLEDGEMENTS

IIT Research Institute (IITRI) has conducted a program to determine the TNT equivalency of mutiperforated M26E1 propellant. This work was conducted for Picatinny Arsenal, Manufacturing Technology Directorate (MTD), Dover, New Jersey under Contract DAAA21-74-C-0521.

Technical guidance was provided by Messrs. P. Price, D. Westover, and S. Levmore of MTD. Personnel who contributed to the full-scale experiments conducted at Dugway Proving Ground, Dugway, Utah include A. K. Keetch and P. E. Miller of the Hazards Evaluation Office.

Subscale experiments were conducted at the IITRI field laboratory, LaPorte, Indiana. IITRI staff who made major contributions to this effort include: M. Amor, J. Cook, C. Foxx, D. Hrdina, R. Joyce, G. Kutzer, H. Napadensky, and J. Swatosh, Jr.

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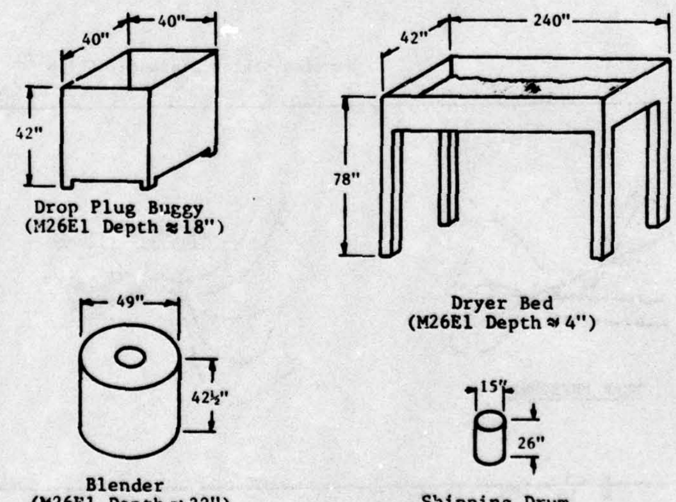
SUMMARY

M26E1 multiperforated propellant was detonated in full-scale shipping drum containers and mocked-up full-scale drop plug buggies, dryer beds, and blenders. Blast output was measured and TNT equivalency was computed based upon a comparison with the explosive blast output of a surface burst of a hemispherically shaped TNT charge. The results of these computations in terms of recommended usage TNT equivalence profiles are presented in the table below and in the following figures:

TNT EQUIVALENCY OF M26E1 PROPELLANT

	TNT Equivalency (percent)							
	$3ft/lb^{1/3}$		$9ft/lb^{1/3}$		$18ft/lb^{1/3}$		$40ft/lb^{1/3}$	
	P	I	P	I	P	I	P	I
Shipping Drum, ≈ 160 lb	200	300	120	100	85	95	60	85
Drop Plug Buggy, ≈ 950 lb	440	225	80	120	200	135	110	110
Dryer Bed, ≈ 1600 lb								
Normal to Long Side	90	90	95	85	75	105	55	95
Normal to Short Side	65	40	75	45	105	130	105	110
Blender, ≈ 1900 lb	270	95	1[illegible]	75	100	115	55	75

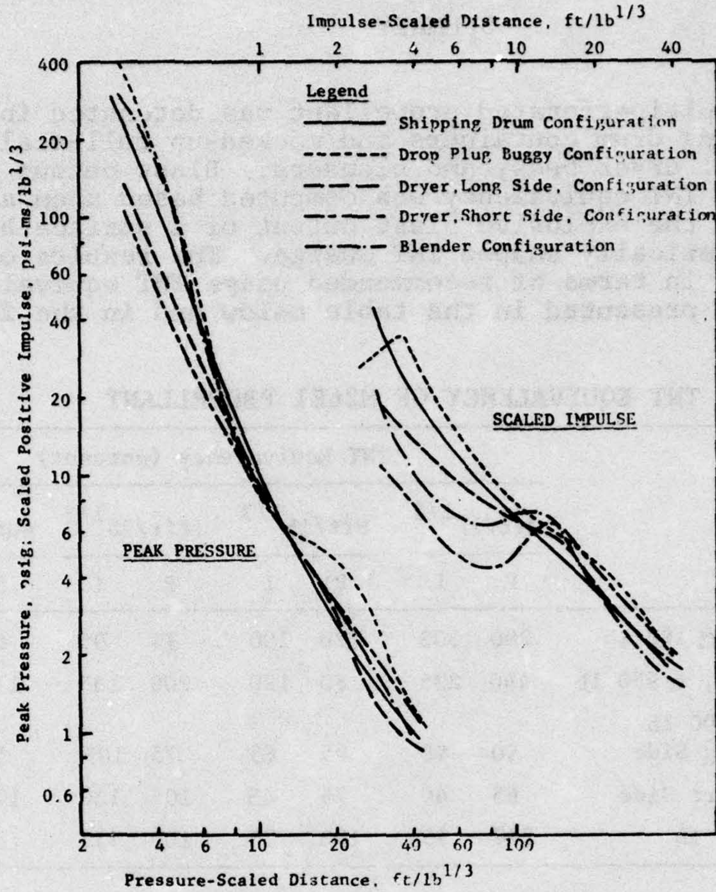


Drop Plug Buggy (M26E1 Depth ≈ 18")

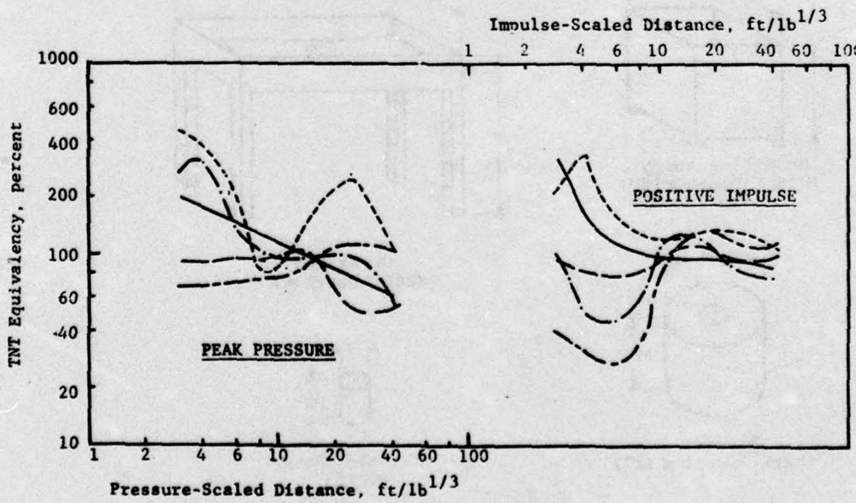
Dryer Bed (M26E1 Depth ≈ 4")

Blender (M26E1 Depth ≈ 32")

Shipping Drum (Full)



PEAK PRESSURE AND SCALED POSITIVE IMPULSE -- M26E1 PROPELLANT



TNT EQUIVALENCY -- M26E1 PROPELLANT

1. INTRODUCTION

1.1 Background

The US Army Materiel Development & Readiness Command began a program to upgrade the safety standards of new and existing ammunition plants. In support of this program, the Manufacturing Technology Directorate of Picatinny Arsenal developed design standards for hardening protective structures to withstand the effects of the detonation of high explosives. Design and safety engineers require data pertinent to the maximum strength of a blast wave that may originate from any of the propellant or deflagrateable materials present in the plant. Since the airblast capabilities of M26E1 propellant could not be obtained from the available literature, Picatinny Arsenal sought to establish the TNT equivalencies of this material.

Past methods used for siting and the design of individual components of explosive manufacturing and related facilities have been based on gross quantities of explosives or propellants. Present day technology has shown that cost effective yet safe facilities can be built, if design criteria are based on the actual explosive output of the materials involved.

A facility designer requires information on the blast pressure-time history, characterized by peak pressure and positive impulse. A considerable amount of prior work has been performed in establishing the airblast parameters of TNT. Consequently, for facility designs involving other energetic materials the design information can be expressed in terms of TNT equivalency. In this report information is presented for peak pressure, positive impulse, pressure TNT equivalency, and impulse TNT equivalency.

Benefits to be realized through this study include significant cost savings, by avoiding the overdesign of structures, and improved safety of personnel by the installation of adequate blast protection.

1.2 Objectives

The program objectives are to:

- experimentally determine the maximum airblast output, peak overpressure and positive impulse of M26E1 multiperforated propellant

- determine the TNT equivalency of M26E1 propellant by comparing its measured pressure and positive impulse with those produced by the detonation of an unconfined hemispherical charge of TNT
- determine if the blast output from M26E1 propellant scales as a function of weight.

2. TEST PROCEDURES

2.1 Test Sites

Subscale tests were conducted at the IITRI explosives research laboratory near LaPorte, Indiana. A schematic diagram of the test area physical arrangement is shown in Fig. 1. It consists of two concrete slabs 75 ft long by 10 ft wide in which 12 pressure transducers were installed. The pressure transducers were mounted flush with the top surface of the concrete slab in mechanically isolated steel plates. The charges were generally located at the ground zero (GZ) indicated on Fig. 1; however, a few tests were conducted with the charge located still further away from the gages in order to obtain larger scaled distances. Pressure and impulse measurements were made 8 to 162 ft from the charges. Scaled distances ranged from 2.3 to over 40 ft/lb$^{1/3}$. The M26E1 charges were always set on a steel witness plate, on ground level.

Full-scale tests were performed at Dugway Proving Ground, Dugway, Utah, at a desert site remote from any buildings or surface obstructions. A schematic plan view of the test site is illustrated in Fig. 2. An earth revetment was made approximately 1800 ft from GZ, and an instrumentation trailer, a portable generator, and a personnel shelter were shielded behind it.

Two land areas approximately 500 x 40 ft were cleared of all brush and leveled. Sixteen pressure gages were flush mounted in steel plates which, in turn, were flush mounted to the ground with stakes. They were located at discrete intervals to two normally perpendicular lines from GZ. Cables from the gages to the instrumentation trailer were buried in the immediate area of the charge and were laid on top of the ground the rest of the way to the instrumentation trailer. The gage positions ranged from 16 to 48 ft from GZ. Only 12 pressure gages were used during any one test, six on each of the two gage lines.

2.2 Test Configurations

Two basic subscale configurations were tested: shipping drums and simulated dryers. Cylindrically shaped scaled-down shipping containers utilizing charge weights of 8, 39, 50 and 65 lb were tested. The aspect ratios of the cylindrical containers were approximately the same as the aspect ratio of a full size (160 lb) cylindrical shipping container ($L/D \approx 1.6$).

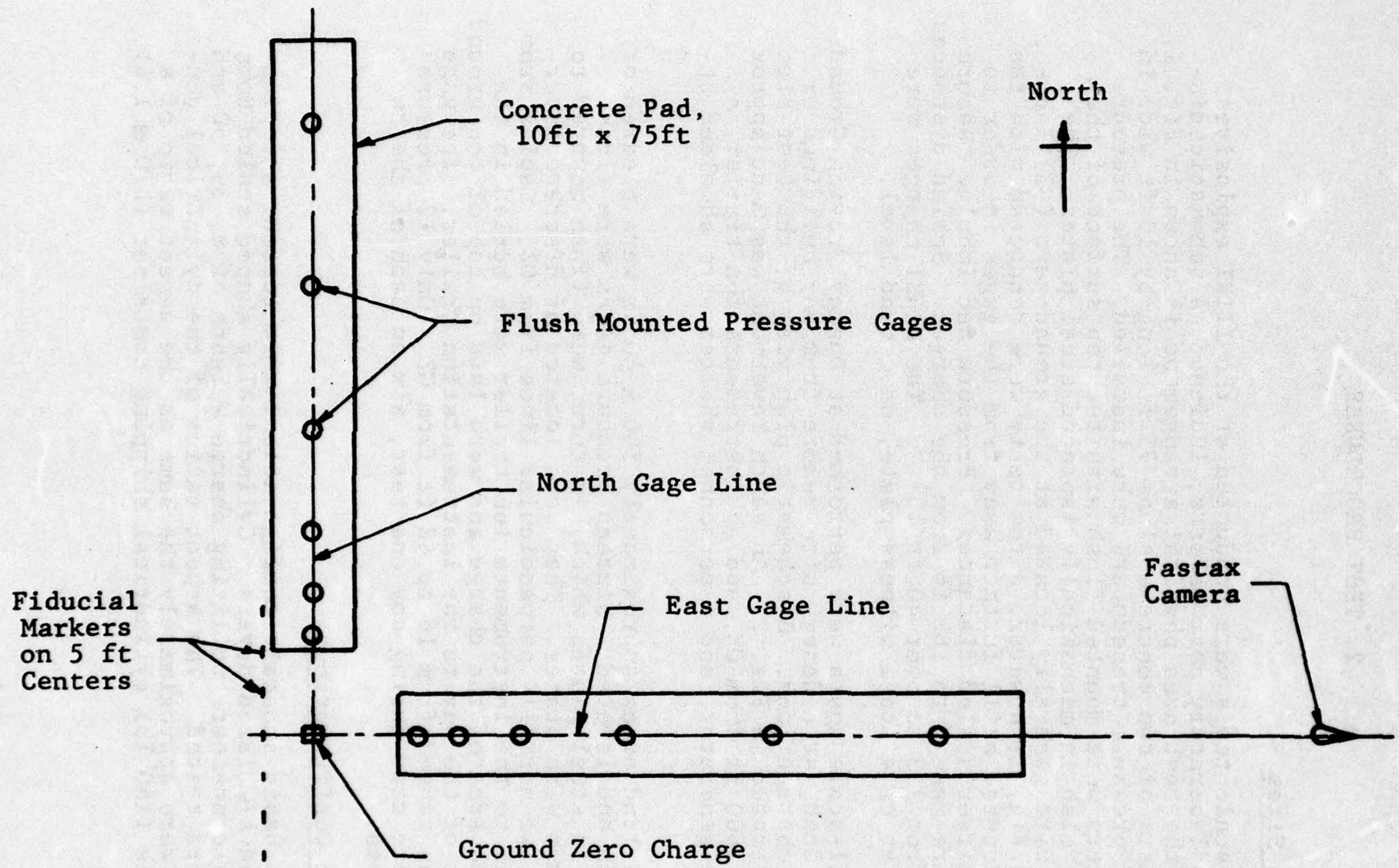


Fig. 1 IITRI TEST AREA

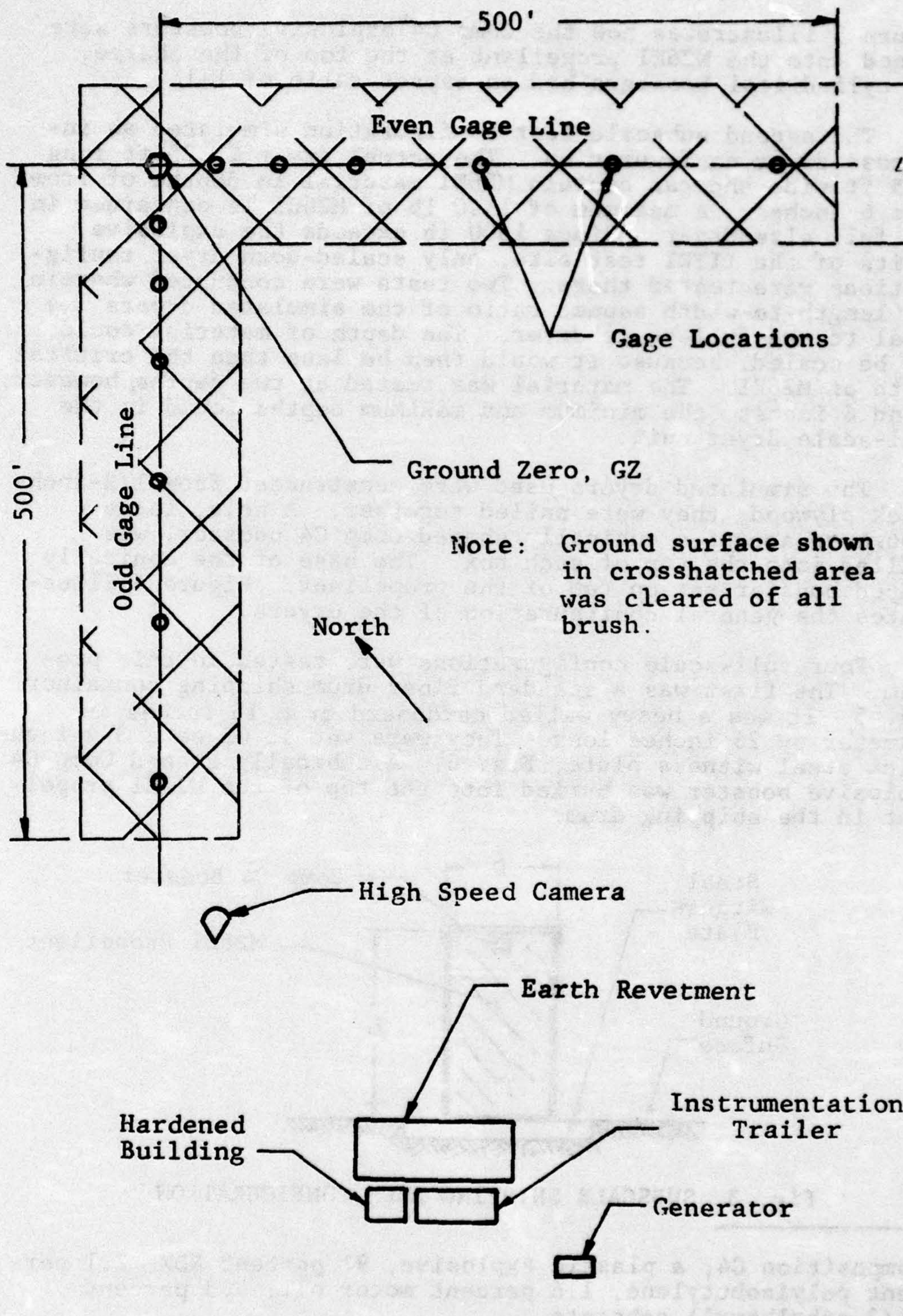


Fig. 2 DPG TEST AREA

Figure 3 illustrates how the Comp C4*explosive boosters were placed into the M26E1 propellant at the top of the charge. The cylindrical boosters had an aspect ratio of 1:1.

The second subscale test configuration simulated an in-process dryer configuration. The actual dryer is 25 ft long by 5 ft wide and can contain M26E1 material in depths of from 3 to 6 inches. A maximum of 1500 lb of M26E1 is contained in the full size dryer. Since 1500 lb exceeds the explosive limits of the IITRI test site, only scaled-down dryer configurations were tested there. Two tests were conducted wherein the length-to-width aspect ratio of the simulated dryers was equal to the full-scale dryer. The depth of material could not be scaled, because it would then be less than the critical depth of M26E1. The material was tested at two depths, however, 3 and 6 inches, the minimum and maximum depths found in the full-scale dryer unit.

The simulated dryers used were constructed from 1/2-inch-thick plywood; they were nailed together. A hole, large enough to accept a conically shaped Comp C4 booster, was drilled into the top of each box. The base of the conically shaped booster sat on top of the propellant. Figure 4 illustrates the general configuration of the dryers.

Four full-scale configurations were tested in this program. The first was a standard fiber drum shipping container, Fig. 5. It was a heavy walled cardboard drum 15 inches in diameter by 26 inches long. They were set at GZ on a 3/4-inch-thick steel witness plate, Fig. 6. A cubically shaped Comp C4 explosive booster was buried into the top of the M26E1 propellant in the shipping drum.

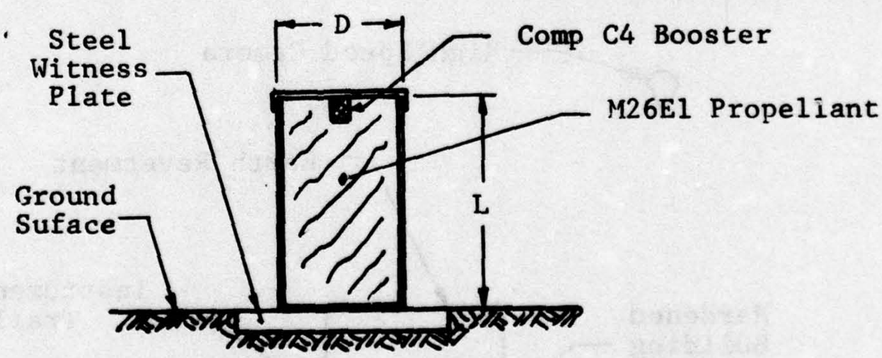


Fig. 3 SUBSCALE SHIPPING DRUM CONFIGURATION

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*Composition C4, a plastic explosive, 91 percent RDX, 2.1 percent polyisobutylene, 1.6 percent motor oil, 5.3 percent di(2-ethylhexyl) sebacate.

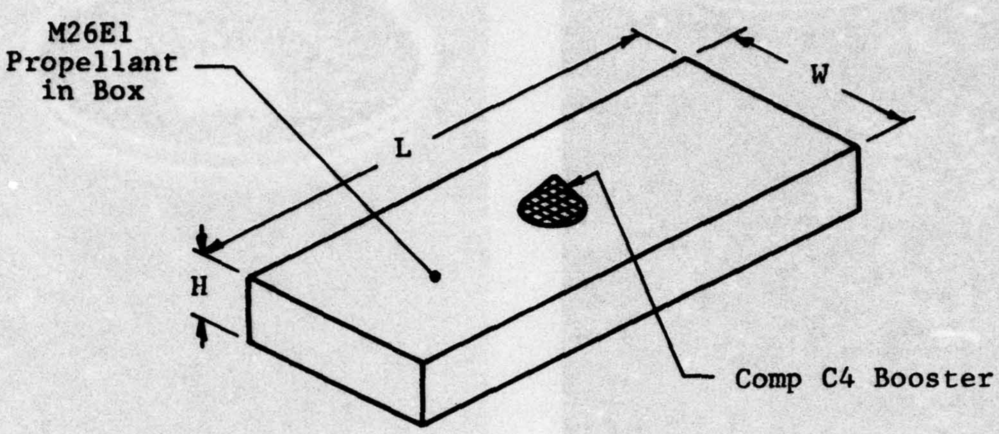


Fig. 4 SUBSCALE DRYER CONFIGURATION

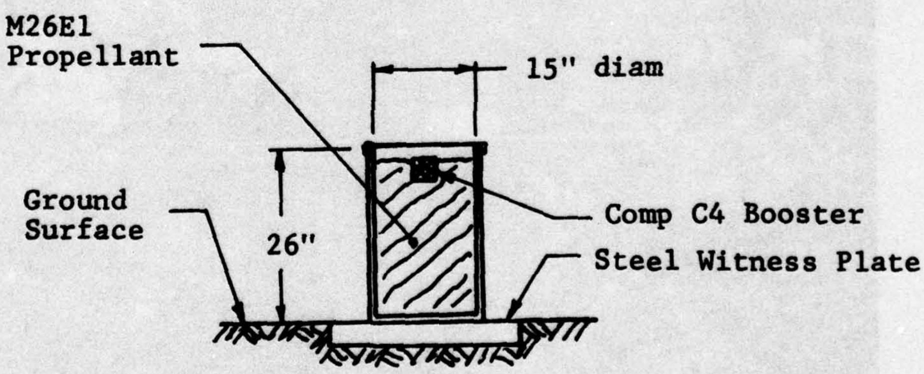
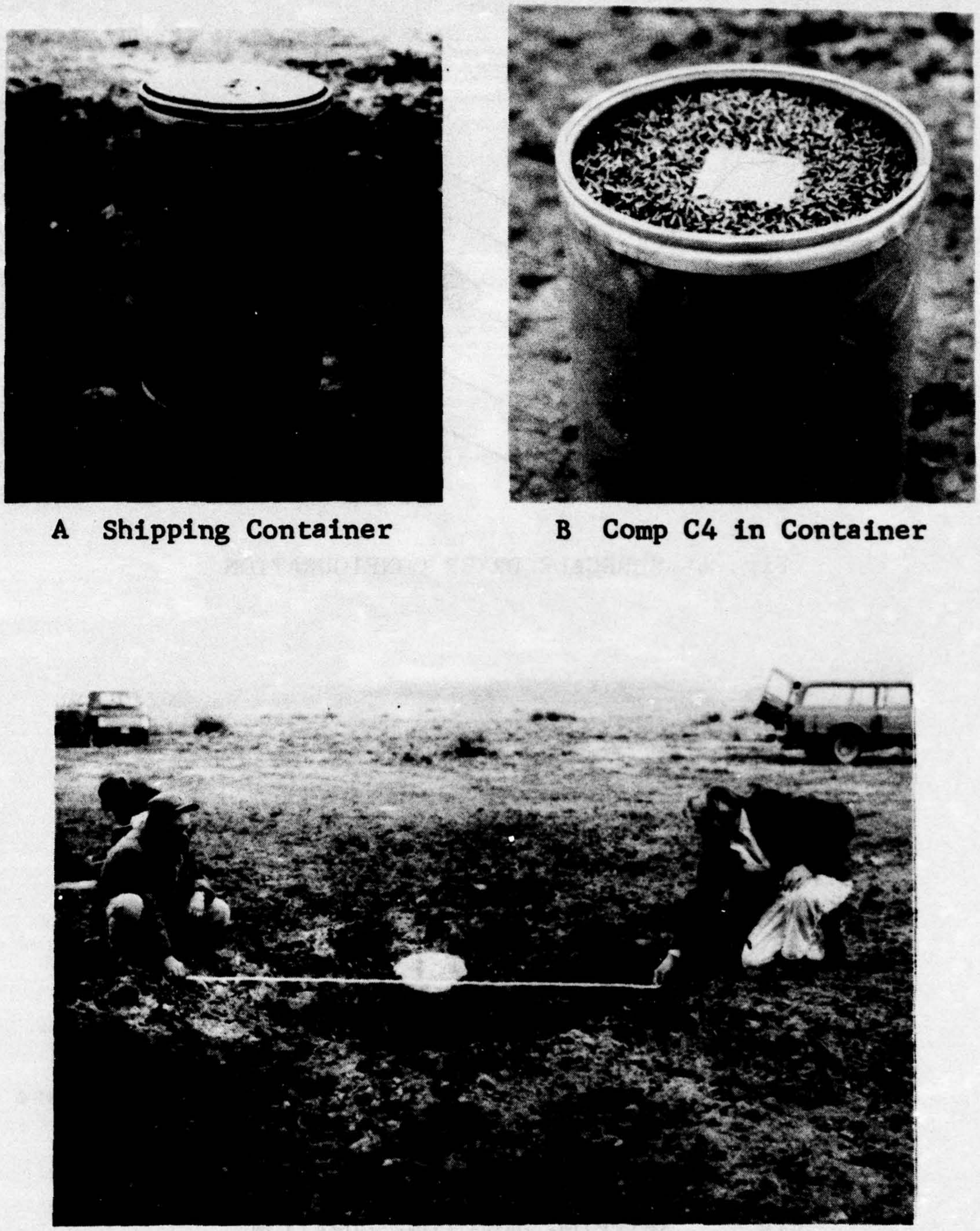


Fig. 5 SHIPPING DRUM CONFIGURATION



A Shipping Container B Comp C4 in Container

C Post-test Crater

Fig. 6 FULL-SCALE M26E1

The second full-scale configuration was a mock-up of a drop plug buggy. They were constructed with 3/4-inch-thick plywood and 2 by 4 inch wood supports (Fig. 7). They were set up off the ground similar to an actual drop plug buggy. Each buggy was loaded with over 900 lb of M26E1 propellant, and a cubical Comp C4 explosive booster was buried in the top center of the propellant pile, Fig. 8.

A dryer bed configuration is illustrated in Fig. 9. They were constructed with 1/2-inch-thick plywood sheets and 2 by 4 inch wood supports, Fig. 10. A plywood cover was nailed over the top of the dryer bed after it was loaded with M26E1 propellant. The average depth of propellant in the simulated dryer bed was 4 inches. The Comp C4 explosive booster was located in the middle of the bed. The bed was oriented such that the long side of the bed was perpendicular to the "odd" gage line and the short side of the bed was perpendicular to the "even" gage line (Fig. 2).

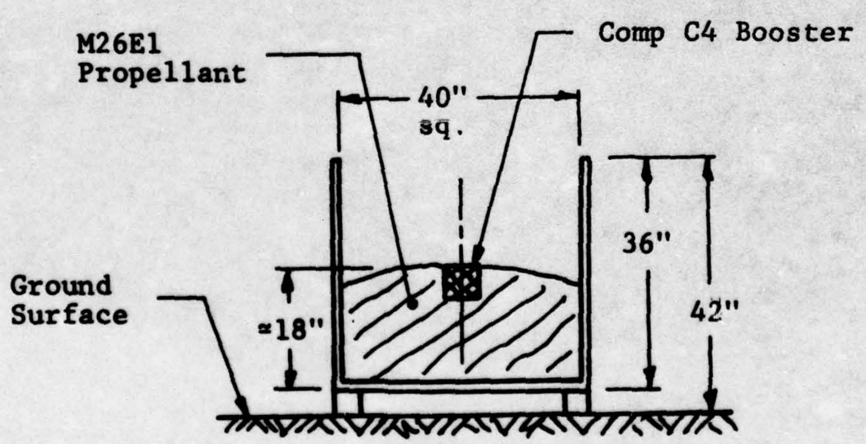
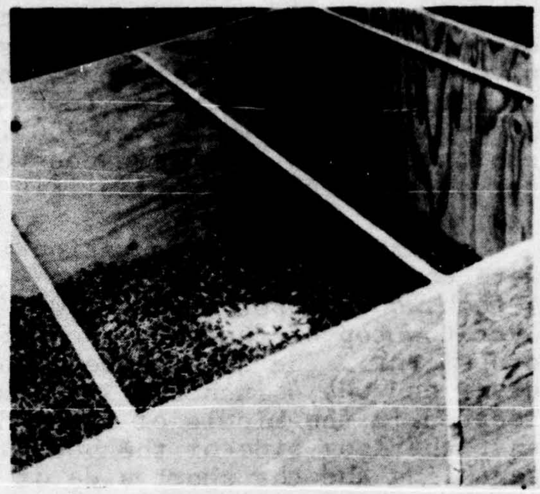
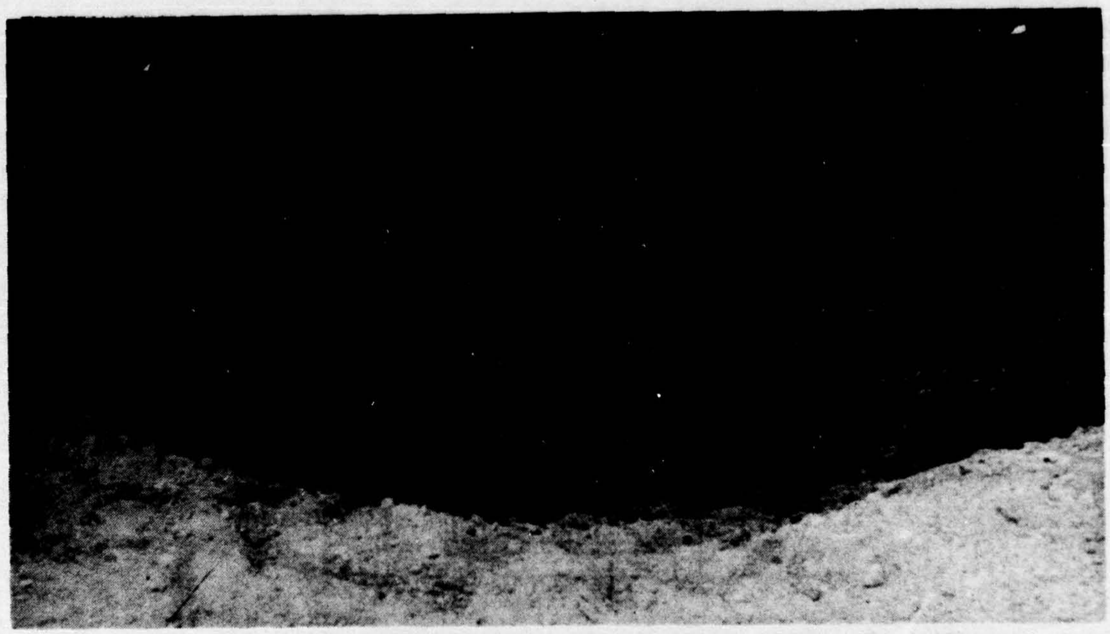


Fig. 7 DROP PLUG BUGGY CONFIGURATION

A Drop Plug Buggy Mock-up



B Comp C4 in Container



C Post-test Crater

Fig. 8 M26E1 DROP PLUG BUGGY CONFIGURATION

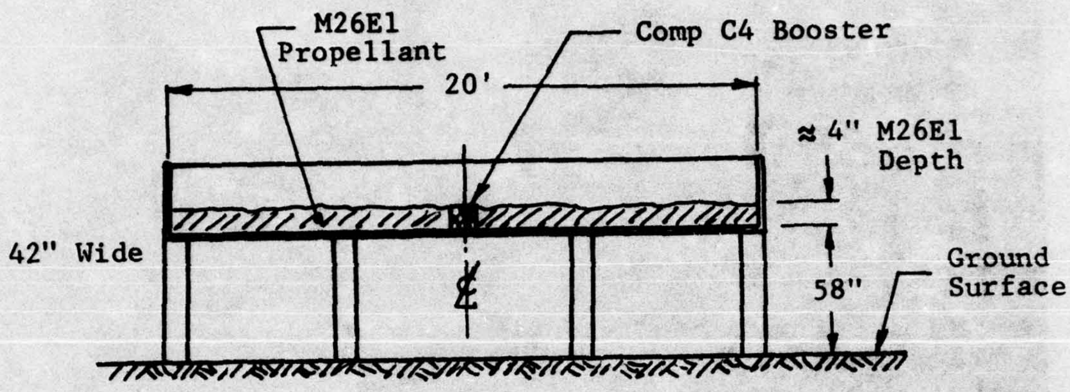


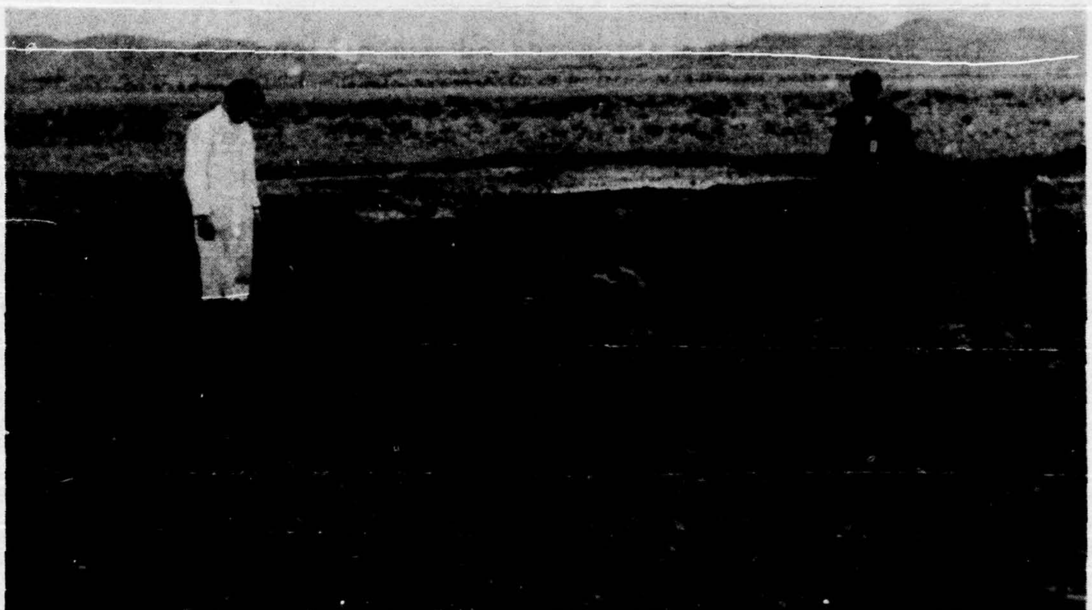
Fig. 9 DRYER BED CONFIGURATION

The fourth configuration tested was a blender barrel, Fig. 11. It was constructed from 3/16-inch-thick steel; all seams were welded together. The Comp C4 explosive boosters were placed in the M26E1 propellant near the top at the center of the blender, Fig. 12.

2.3 Verification Tests

During the course of this test program several field verification tests were performed to confirm the recording accuracy of the pressure and impulse measuring systems. They consisted of measuring the peak pressure and positive impulse from 5 to 100 lb hemispherical Comp C4 explosive charges, Fig. 13. The charges were set on steel witness plates at ground level. Pressure and impulse data obtained from the C4 verification shots are compared to established TNT hemispherical surface burst data (the increased energetics of Comp C4 is accounted for). All of the gage systems used in these tests had been previously calibrated in a laboratory using accepted standards. The laboratory calibrations were used throughout the program. The verification tests indicated that the instrumentation systems were functioning properly.

A Filling Dry Bed Configuration



B Post-test Crater

Fig. 10 DRY BED MOCK-UP

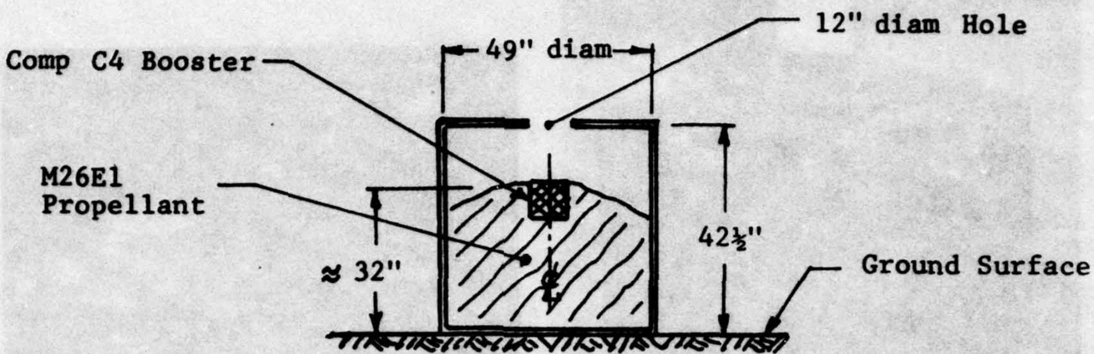


Fig. 11 BLENDER CONFIGURATION

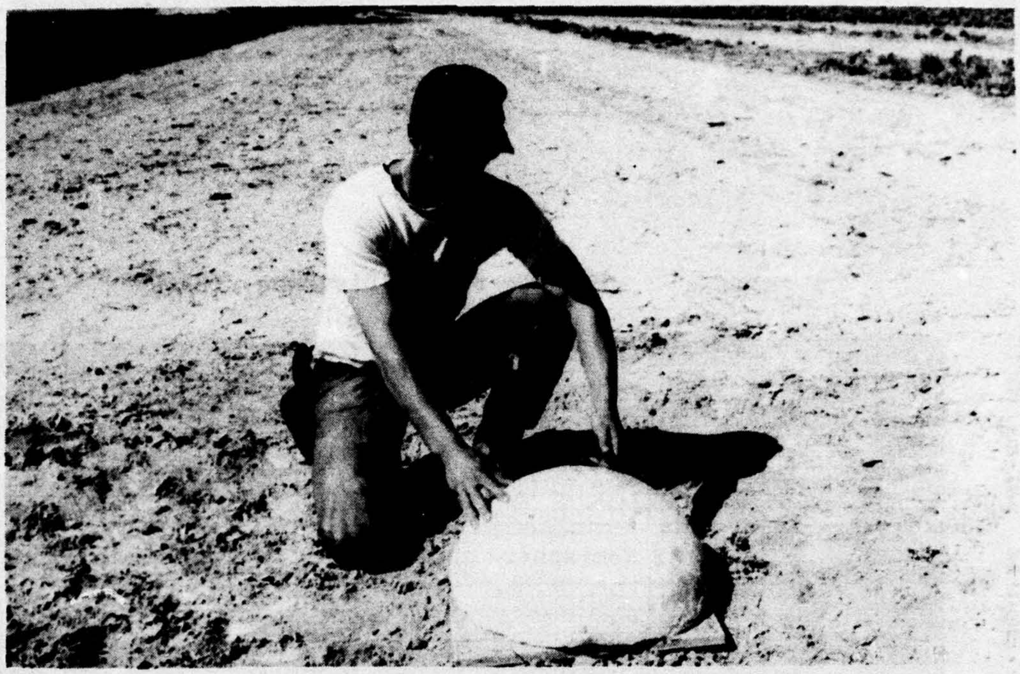
The resulting pressure and impulse data points for the various scaled distances of the verification shots are plotted in Fig. 14. The close groupings of the various sets of points provide a good basis of confidence in the proper functioning of the blast gages. The line that passes through the "peak overpressure" gage points is a TNT pressure curve used as a standard; it was generated by Kingery, BRL 1344, 1966. The line passing through the "scaled positive impulse" points was generated by IITRI for Comp C4. It utilizes a 1.25 factor to convert the weight of Comp C4 to the equivalent weight of TNT. Both of these reference curves are built into the IITRI computer program. Consequently, all of the TNT equivalencies shown in this report are computed from these reference curves.

A Blender

B Comp C4 in Blender

C Post-test Configuration

Fig. 12 BLENDER CONFIGURATION



A Comp C4 Charge, 100 lb

B Posttest Crater

Fig. 13 COMP C4 VERIFICATION TEST

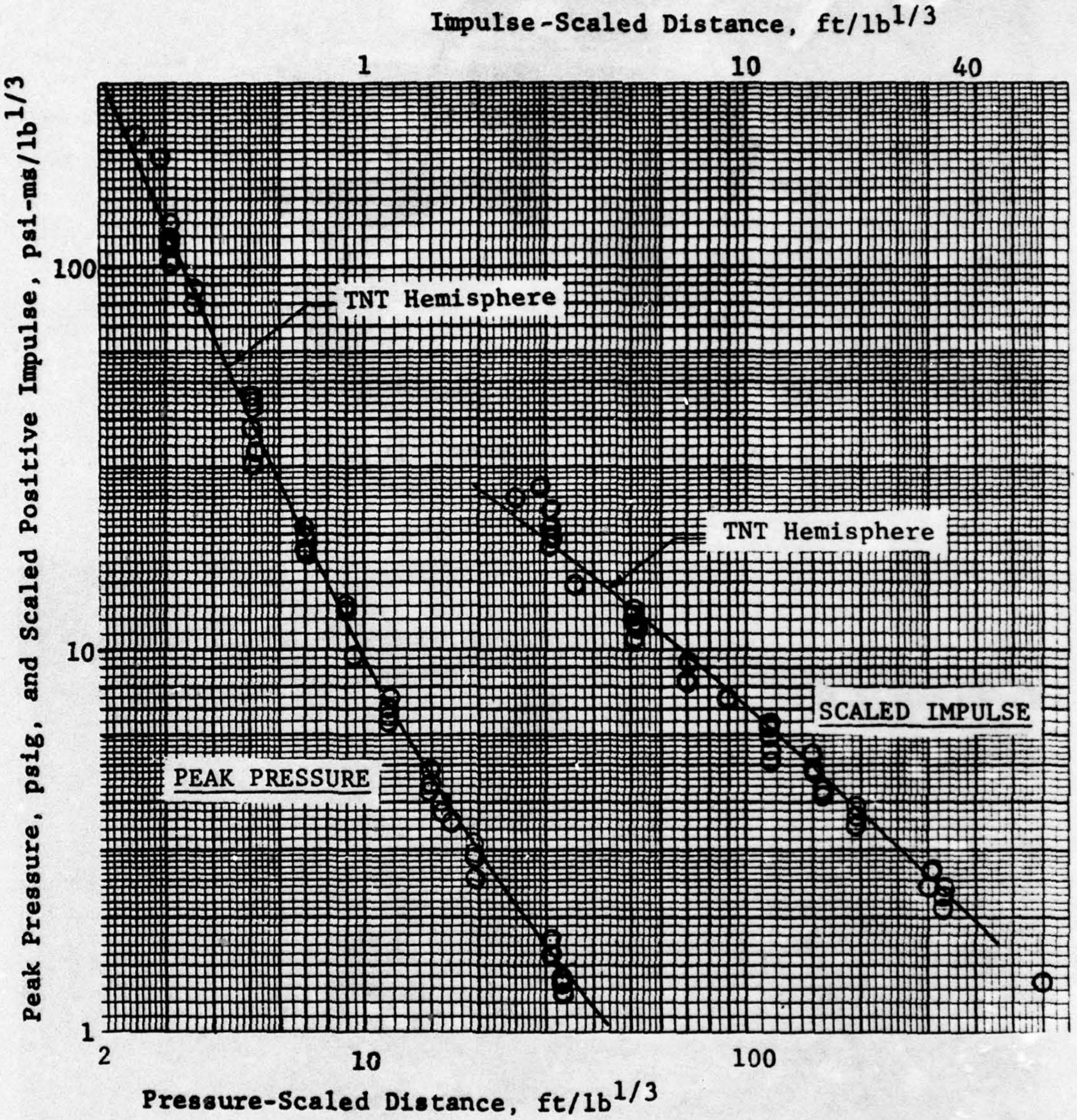


Fig. 14 TNT HEMISPHERE PRESSURE AND IMPULSE CURVES

3. TEST RESULTS

The appendixes of this report contain field data sheets which give test descriptions and evaluations of each full-scale test after they were shot. They also contain the raw test data and the computer printout of TNT equivalencies for individual data points. All of the scaled quantities noted in this report have been corrected to include the weight of the booster, in terms of its equivalent weight of M26E1, in the total charge weight.

3.1 Shipping Drum Configuration

The tests conducted with the shipping drum configuration are tabulated in Table 1. The first four tests were conducted to determine the minimum size booster required to obtain maximum blast output from the M26E1 charges. The ratios of Comp C4 booster weight/M26E1 charge weight, in percent, were 0.4, 0.9, 1.8 and 2.3 percent for the first four tests respectively. There was evidence of unignited propellant in the test area after each of the first three tests with 50 lb charges. As the booster size increased, the quantity of unconsumed propellant decreased. No unreacted propellant was found after a 2.3 percent by weight (680 gm) booster was used for a 65 lb charge. Six additional tests were then carried out using 65 lb charges and 680 gm boosters. The peak pressure and scaled positive impulse measured from these first 10 tests are shown in Fig. 15. Note that two curves without data points, labeled M26-4(7), have been drawn to depict the results of the seven tests with 65 lb charges and 680 gm boosters, one for pressure and one for impulse. These curves represent an eye-fit through the data of the seven tests.

The peak pressure curve for a test with a 1.8 percent by weight (400 gm) booster and the composite curve for tests using 2.3 percent boosters are virtually identical over the scaled distance range of 2 to 20 ft/lb$^{1/3}$ indicating little difference in effect of booster size. Comparison of the impulse curves in Fig. 15 shows that the results from a test with a 0.9 percent by weight (200 gm) booster are also very close to that of the 2.3 percent (680 gm) booster.

Further experiments in scaled simulated shipping containers were conducted with charge weights (39 and 8 lb) significantly lower than the 65 lb tests. These are shown in Fig. 16 in comparison with the composite curve of the seven 65-lb tests. For the first of the 8 lb charge weight tests, a 2.7 percent by weight (100 gm) booster was used; however, unreacted propellant was again found scattered about the test site.

TABLE 1

M26E1 SHIPPING DRUM CONFIGURATION TESTS

Test*	Shipping Drum Size (inches)	Charge Weight (lb)	Booster Weight (gm)	W_B/W_C** (percent)	Field Observations
M26-1	11D x 19H	50	100	0.4	Unreacted Propellant Found
M26-2	11D x 19H	50	200	0.9	Unreacted Propellant Found
M26-3	11D x 19H	50	400	1.8	Unreacted Propellant Found
M26-4	11D x 19H	65	680	2.3	No Unreacted Propellant Found
M26-5	11D x 19H	65	680	2.3	No Unreacted Propellant Found
M26-6	11D x 19H	65	680	2.3	No Unreacted Propellant Found
M26-7	11D x 19H	65	680	2.3	No Unreacted Propellant Found
M26-13	11D x 19H	65	680	2.3	No Unreacted Propellant Found
M26-14	11D x 19H	65	680	2.3	No Unreacted Propellant Found
M26-15	11D x 19H	65	680	2.3	No Unreacted Propellant Found
M26-8	9-1/2D x 15-1/4H	39	400	2.3	No Unreacted Propellant Found
M26-9	9-1/2D x 15-1/4H	39	400	2.3	No Unreacted Propellant Found
M26-10	5-3/4D x 9H	8	100	2.7	Unreacted Propellant Found
M26-11	5-3/4D x 9H	8	200	5.5	No Unreacted Propellant Found
M26-12	5-3/4D x 9H	8	200	5.5	No Unreacted Propellant Found
A-M26-1	15D x 26H	158½	4 lb	2.5	No Unreacted Propellant Found
A-M26-2	15D x 26H	158¼	4 lb	2.5	No Unreacted Propellant Found
A-M26-3	15D x 26H	158¼	4 lb	2.5	No Unreacted Propellant Found

* Tests grouped according to charge weight

** W_B/W_C = (Booster Weight/Charge Weight) x 100

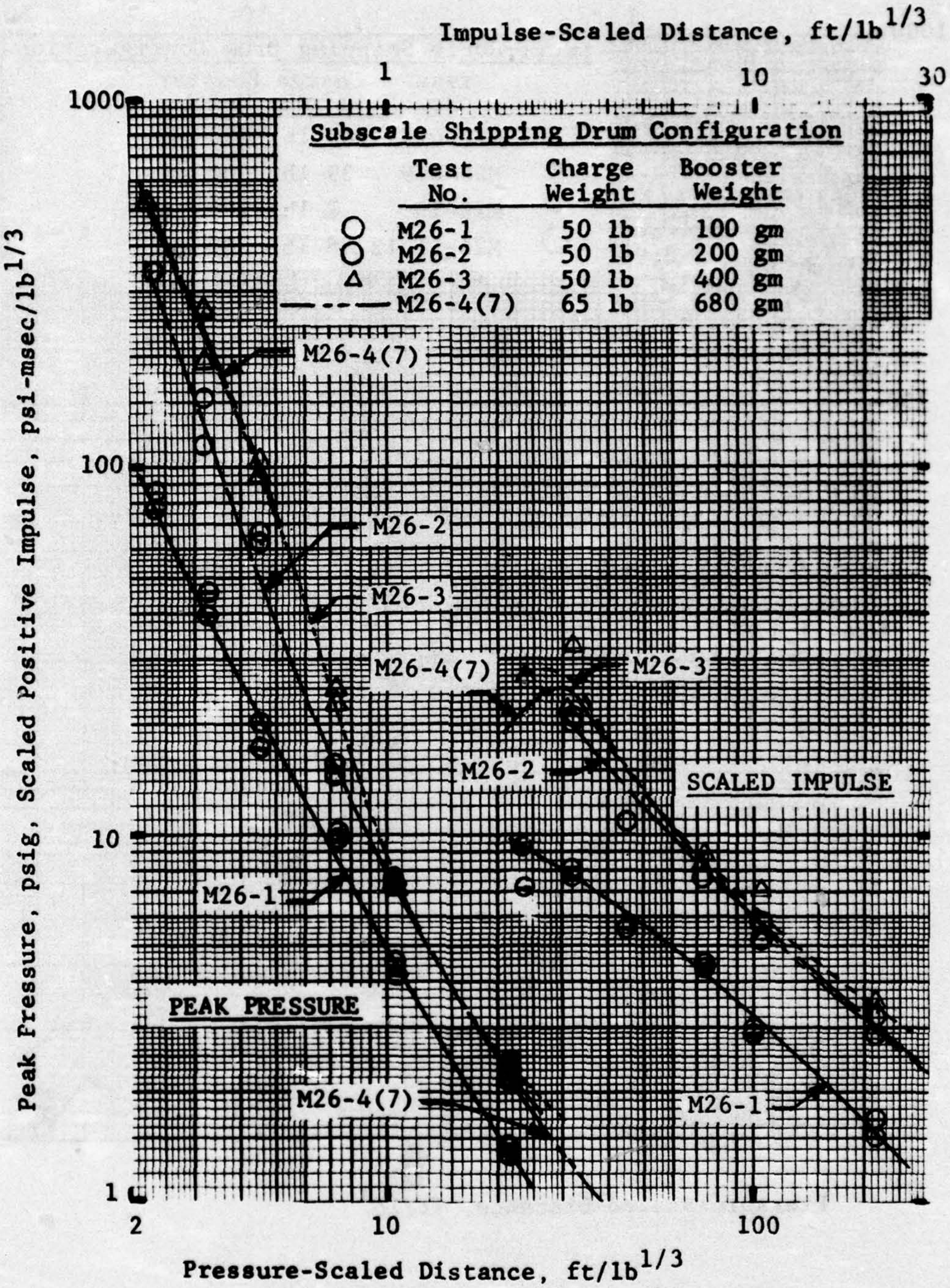


Fig. 15 BOOSTER WEIGHT EFFECTS

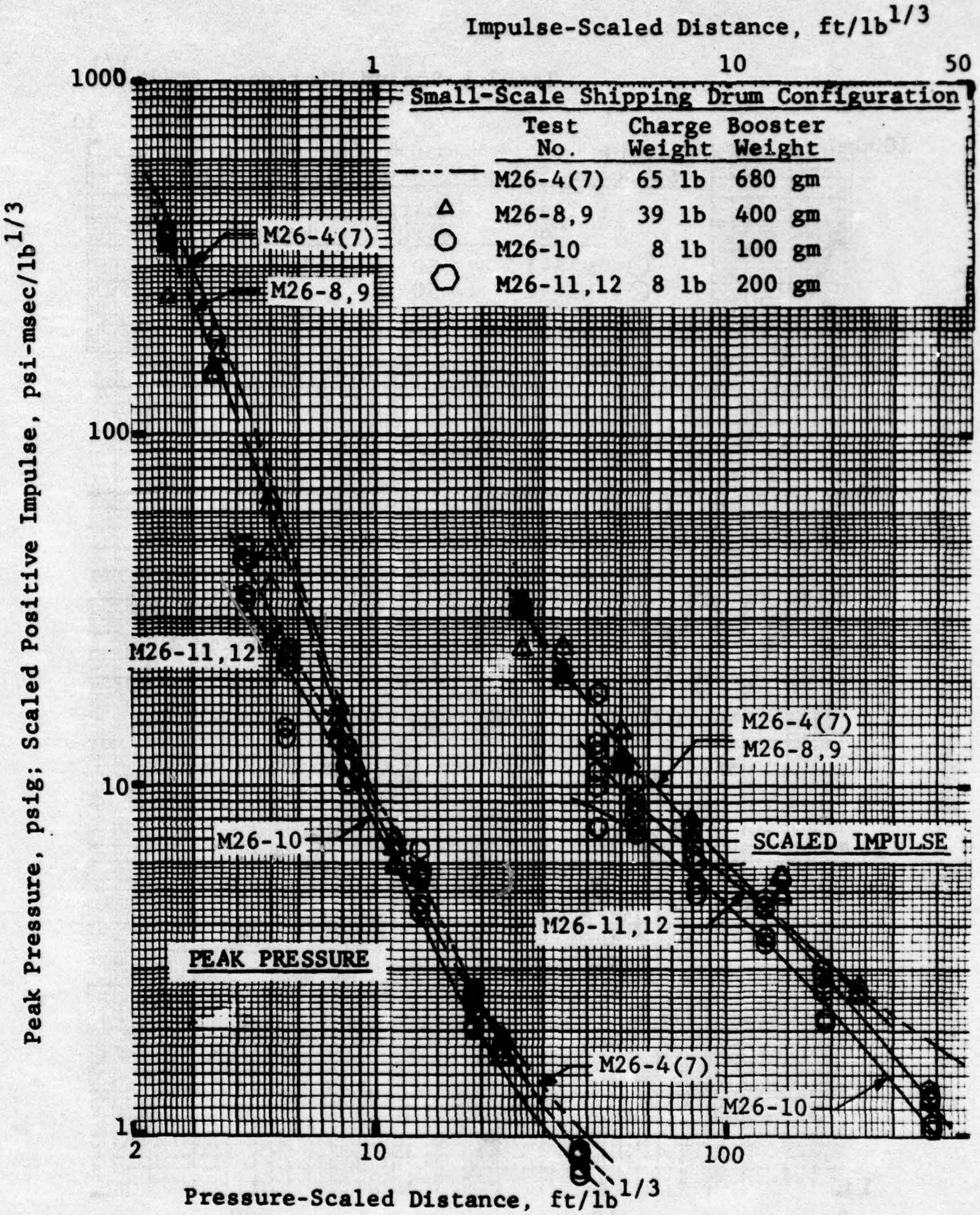


Fig. 16 CHARGE WEIGHT EFFECTS

Two more tests were conducted at 8 lb using 5.5 percent boosters, resulting in no unreacted propellant remaining after the tests. However, the scaled blast output was still low in comparison to the larger weight tests, Fig. 16. Both the pressure and scaled impulse results from two tests with 39 lb charge weights and the seven tests compare very closely over the scaled distance range of 2 to ≈25 ft/lb$^{1/3}$ indicating that maximum blast output effects have most likely been observed at these charge weights and configuration.

Figure 17 presents all of the peak pressure and scaled impulse data obtained from the seven tests with 65 lb charge weight shipping containers.

Three tests were conducted with 160 lb M26E1 propellant in full-scale shipping drum configurations, A-M26-1,2,3. In all three tests, a cubical 4 lb Comp C4 explosive booster was located at the top of the charge. A 4 lb Comp C4 booster is approximately 2.5 percent, by weight ratio, as large as the M26E1 charge. In these tests no unignited propellant was observed in the test area post-test, thereby indicating that all of the propellant was consumed in the tests. Relatively large craters were formed and the steel witness plates were bent and spalled. The results of these tests are plotted on Fig. 18. The curve is an eye-fit average through the data points. The dashed curve represents the averaged results of seven 65-lb charge M26E1 tests.

The 65 lb test curves fall within the range of data scatter except at very small scaled distances. This indicates that for the most part the blast output from M26E1 in this configuration and weight range (i.e., 65 to 160 lb) scales. Tests with smaller quantities of M26E1 indicated a trend where the blast output was increasing with increasing charge weight. It should be noted that the pressure-time profiles of the recorded blast output were classically shaped, an initial peak shock wave followed by an exponential pressure decay. Figure 19 illustrates the effect of charge weight on peak pressure output for selected scaled distances (3, 9, 18 and 40 ft/lb$^{1/3}$).

3.2 Drop Plug Buggy Configuration

There is an air gap between the ground surface and the bottom of the M26E1 propellant charge, Fig. 7. An actual drop plug buggy is similarly supported above the ground by a set of wheels. The pressure-time profiles recorded at any given distance from these charges were multipeaked as a consequence of this particular configuration. Multiple shock reflections from the ground surface coupled with the low profile of the charge contributed to the non-ideal pressure-time waveforms,

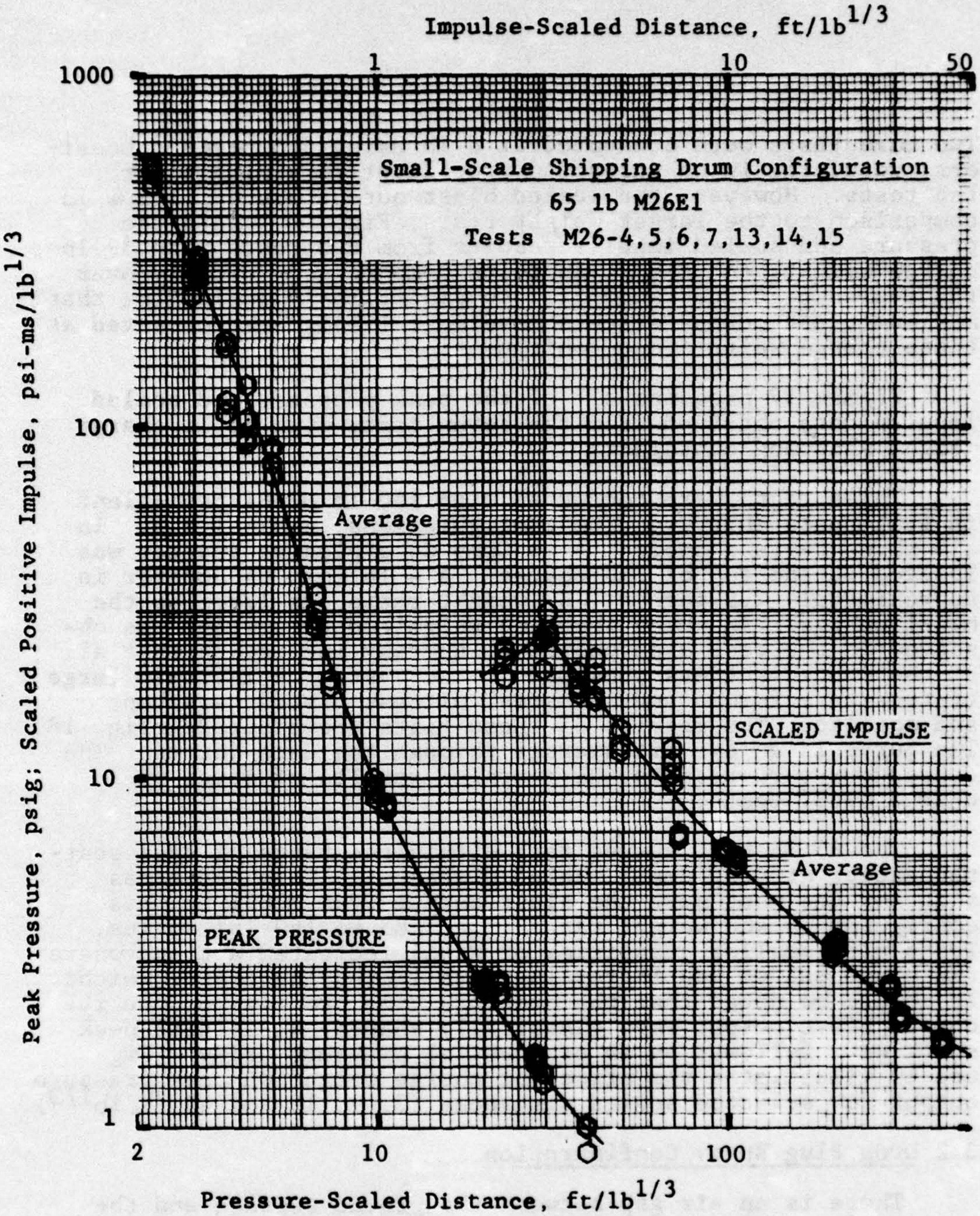


Fig. 17 PRESSURE AND SCALED IMPULSE, SMALL-SCALE SHIPPING DRUM CONFIGURATION

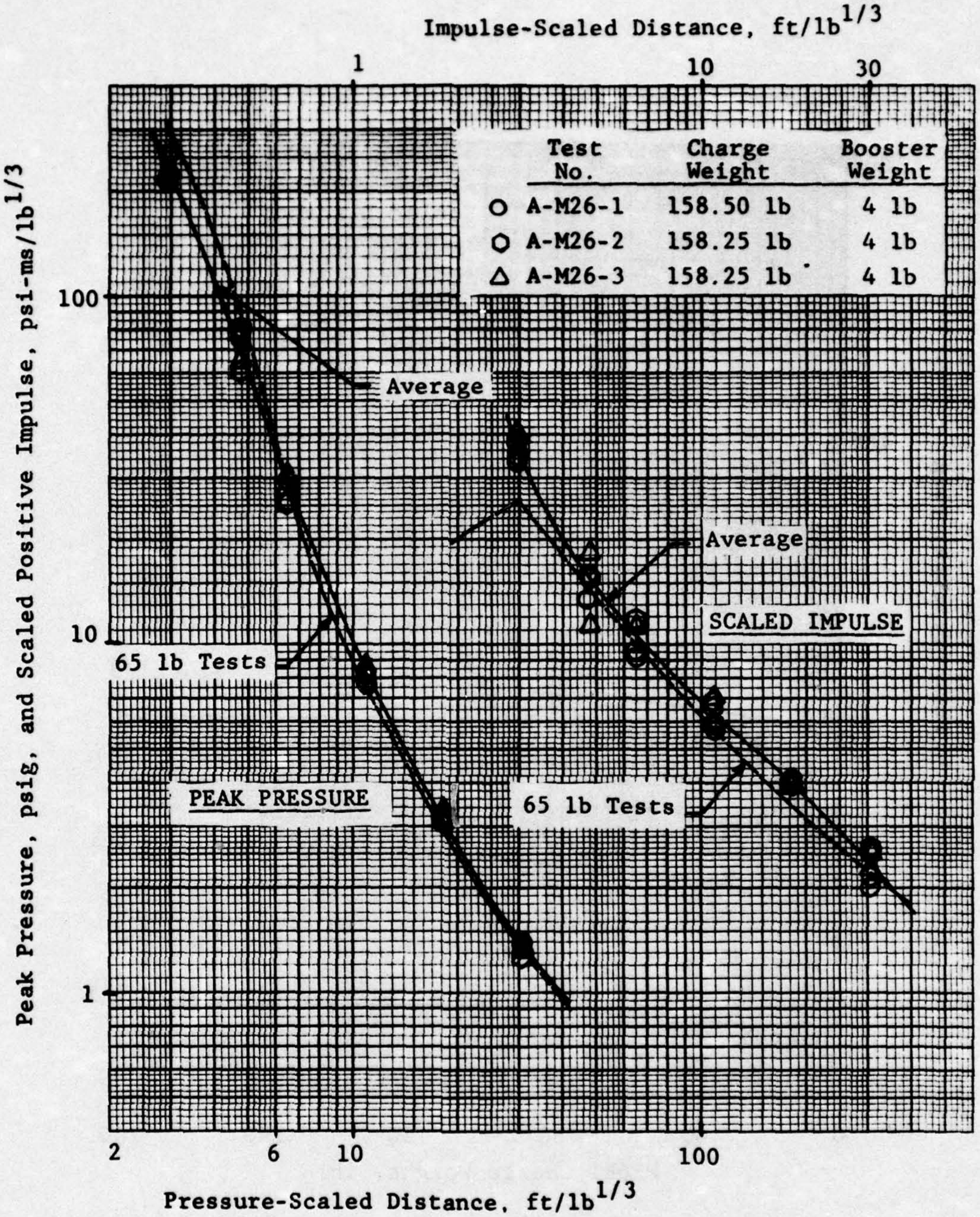


Fig. 18 **PRESSURE AND SCALED IMPULSE, FULL-SCALE SHIPPING DRUM CONFIGURATION**

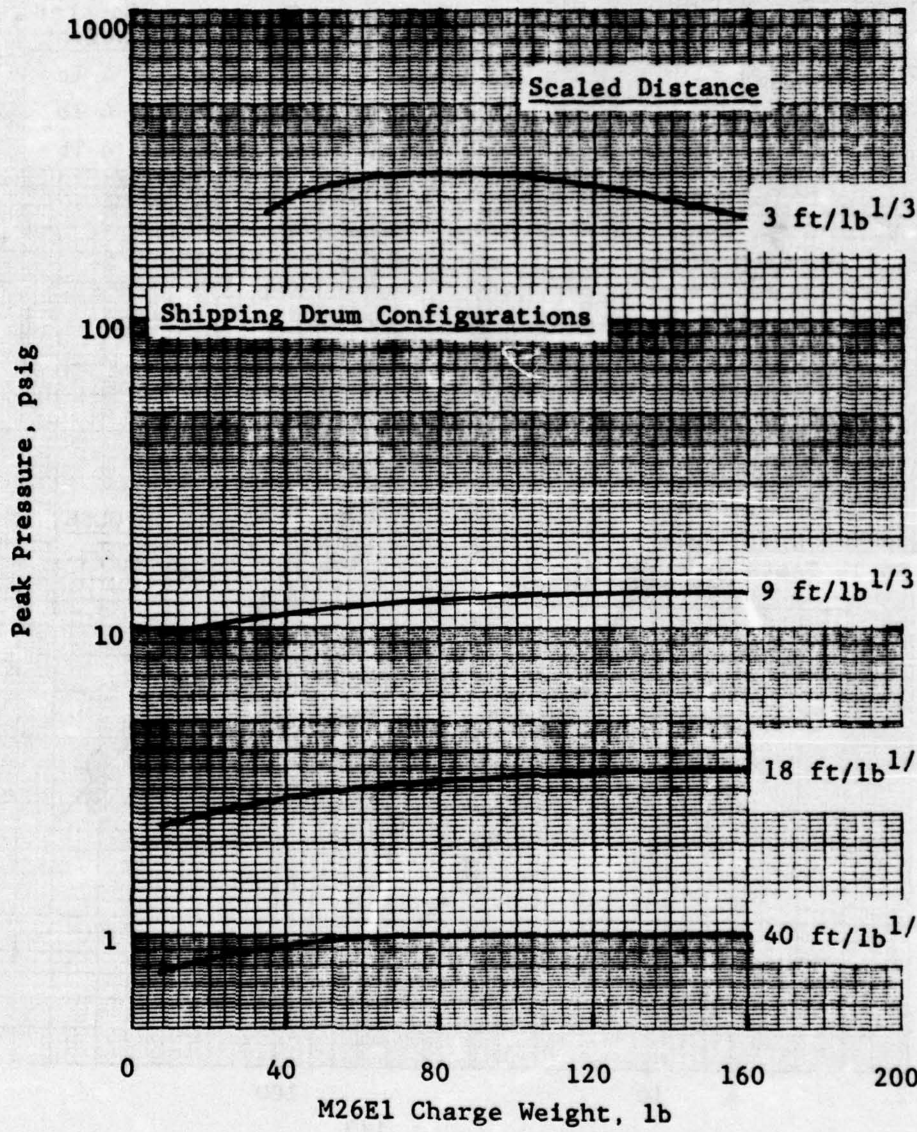


Fig. 19 PEAK PRESSURE vs CHARGE WEIGHT

The three tests conducted are listed in Table 2.

TABLE 2

DROP PLUG BUGGY TESTS

Test	Charge Weight (lb)	Booster Weight (lb)	W_B/W_C (percent)
E-M26-1	951½	25	2.6
E-M26-2	944¼	25	2.6
E-M26-3	955½	25	2.6

The results of these drop plug buggy tests are shown in Fig. 20. The peak pressure data points shown are the peak pressures recorded and are not necessarily the first shock wave pulse in the pressure-time profile. At scaled distances greater than 10, the multiple shock pulses start to noticeably coalesce and consequently the peak pressure is enhanced as evidenced by the hump in the pressure-distance curve at a scaled distance of approximately 17 $ft/lb^{1/3}$. In all of these tests the M26E1 propellant charge was totally consumed.

3.3 Dryer Bed Configuration

The tests are summarized in Table 3.

TABLE 3

DRYER BED CONFIGURATION TESTS

Test	Charge Weight (lb)	Booster Weight (lb)	W_B/W_C (percent)	Dimensions
M26-B1	58.0	1.5	2.6	17"x17"x6" Depth
M26-B2	60.0	1.5	2.5	38"x7-1/2"x6" Depth
M26-B3	59.5	1.5	2.5	53-3/4"x10-3/4"x3" Depth
F-M26-7	1586.0	12.5	0.8	20'x41-1/2"x4" Depth
F-M26-8	1598.0	13.5	0.8	20'x41-1/2"x4" Depth
F-M26-9	1584.0	13.7	0.9	20'x41-1/2"x4" Depth

The dryer bed configuration is one from which a complicated multipeaked blast pressure field is generated. Since the dryer bed is nonsymmetric one can expect different blast fields in the two perpendicular directions in which pressure and impulse are measured. The maximum peak pressure measured at any one gage station was not necessarily the first peak in

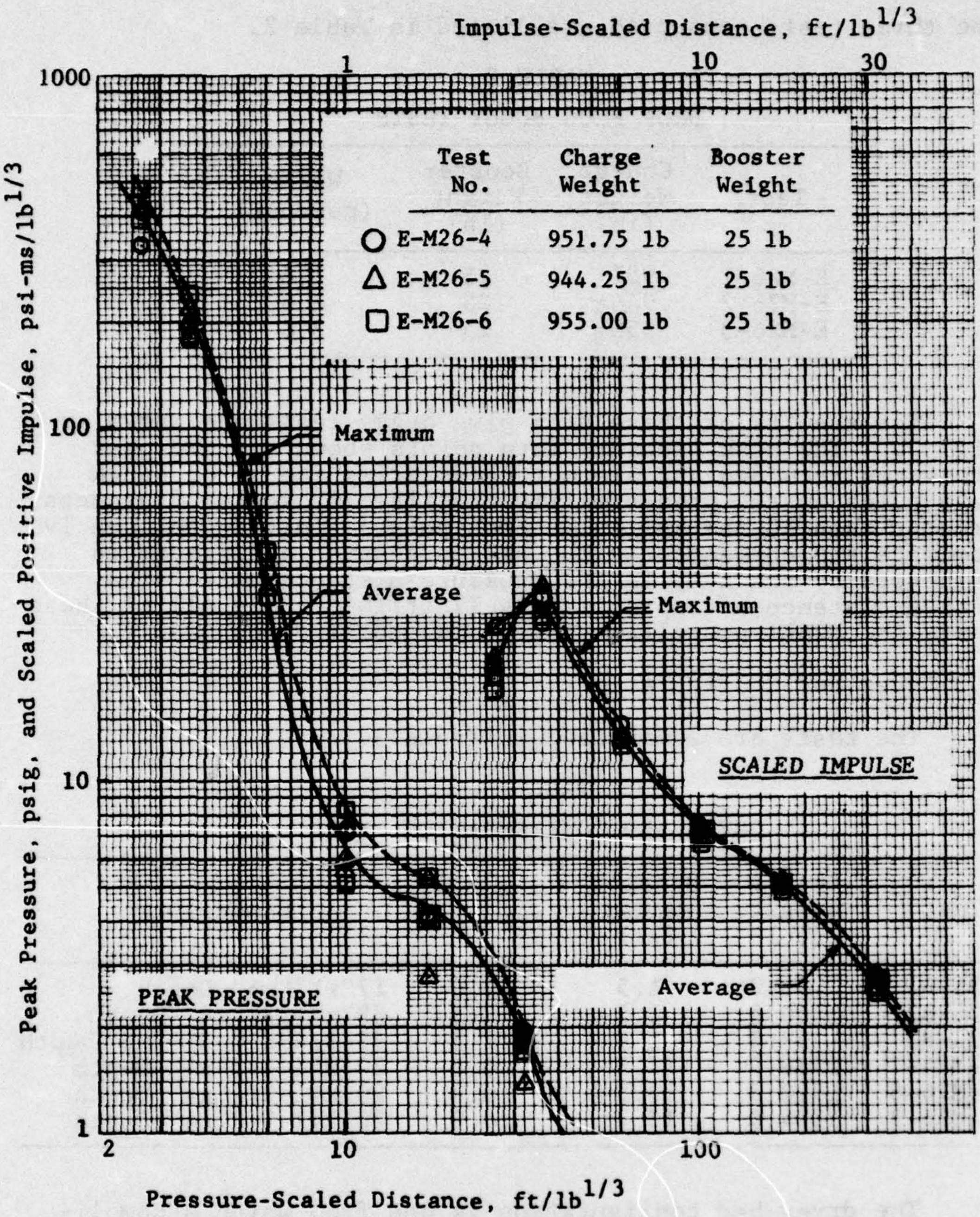


Fig. 20 PRESSURE AND SCALED IMPULSE, FULL-SCALE DROP PLUG BUGGY CONFIGURATION

the pressure-time waveform. Coalescence of shock waves occurred and, consequently, the pressure-distance and impulse-distance curves are not smooth.

The first subscale dryer test, M26-B1, was a square shaped box and consequently was symmetrical with respect to the two 90 degree gage lines. Peak pressure and positive impulse for this shot is plotted on Fig. 21. Data points from both gage lines were used to obtain the curves shown for Test M26-B1. The wave shapes of the pressure time records were hashy, consisting of many peaks in contrast to a classical single peaked blast wave.

Results from dryer configuration tests M26-B2 and M26-B3 are plotted on Figs. 21 and 22. These configurations were not symmetrical with respect to the two gage lines and different results were obtained in each direction. Pressure and impulse measured normal to the long side or length of the box are plotted on Fig. 21. Pressure and impulse measured normal to the short side or width of the box are plotted on Fig. 22. For comparison, the pressure and impulse curves, without data points, of test M26-B1 are repeated on Fig. 22.

Figures 21 and 22 show that peak pressure and positive impulse are greater in the direction normal to the long side of the box. Since the same booster weight (680 gm) and approximately the same charge weight ($\approx$60 lb) were used for all three tests, the differences in the measured blast output are most likely due to the differences in geometry.

For tests M26-B1 and M26-B2, the same material depth, 6 inches, was used. When the material depth was reduced to 3 inches (test M26-B3), the blast output was reduced considerably in both directions. The 3 inch depth could be close to the critical depth of M26E1 propellant and consequently the blast output would be lower.

Results of the full-scale dryer configuration tests, F-M26-7,8, and 9, are illustrated on Figs. 23 and 24. At scaled distances less than $\approx$13 ft/lb$^{1/3}$ pressure and impulse in the direction perpendicular to the longest side of the box is greater than in the direction perpendicular to the short side of the box. At larger distances the reverse is true.

A small weight Comp C4 booster was used to ignite these charges. It was located in the center of the bed of M26E1. The Comp C4 cube was approximately as thick as the 4 inch depth of the M26E1 bed. A larger weight cubical booster would have extended out of the M26E1 propellant and probably would not have contributed to the ignition of the propellant. No unreacted propellant was found in the area post-test.

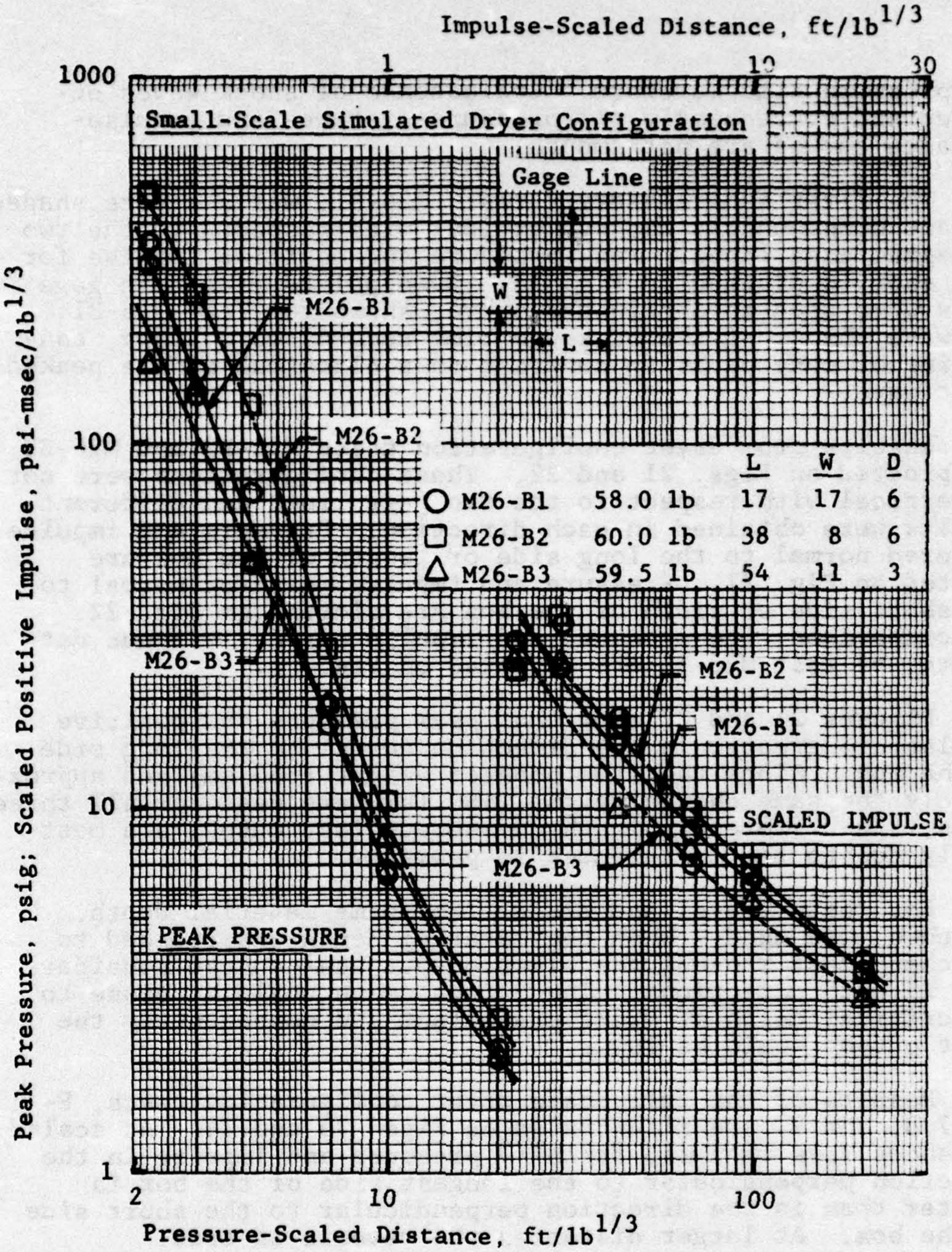


Fig. 21 PRESSURE AND SCALED IMPULSE, SMALL-SCALE DRYER CONFIGURATION, MEASURED NORMAL TO LONG SIDE

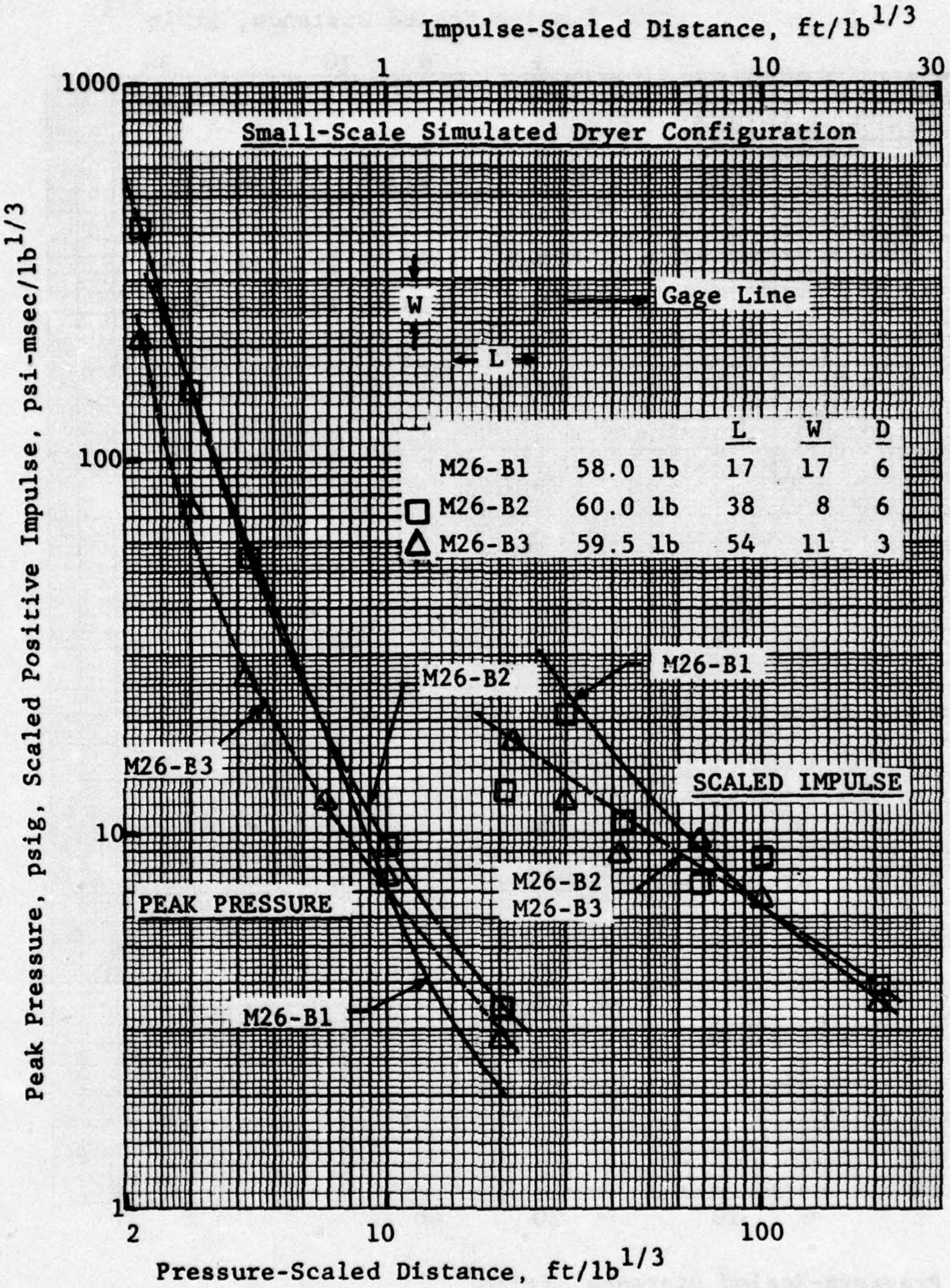


Fig. 22 PEAK PRESSURE AND SCALED IMPULSE, SMALL-SCALE DRYER CONFIGURATION, MEASURED NORMAL TO SHORT SIDE

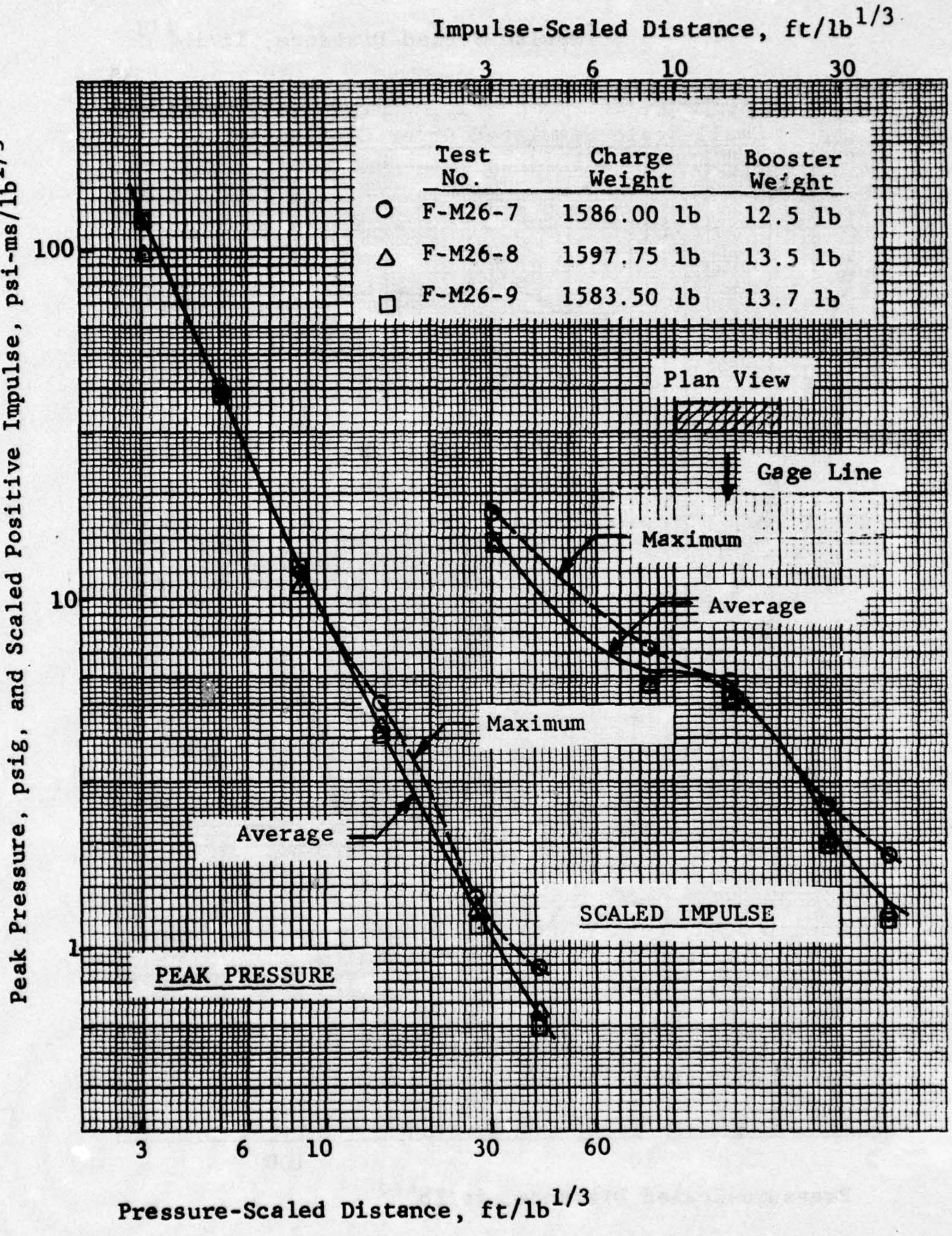


Fig. 23 PRESSURE AND SCALED IMPULSE, FULL-SCALE DRYER BED CONFIGURATION, MEASURED NORMAL TO LONG SIDE

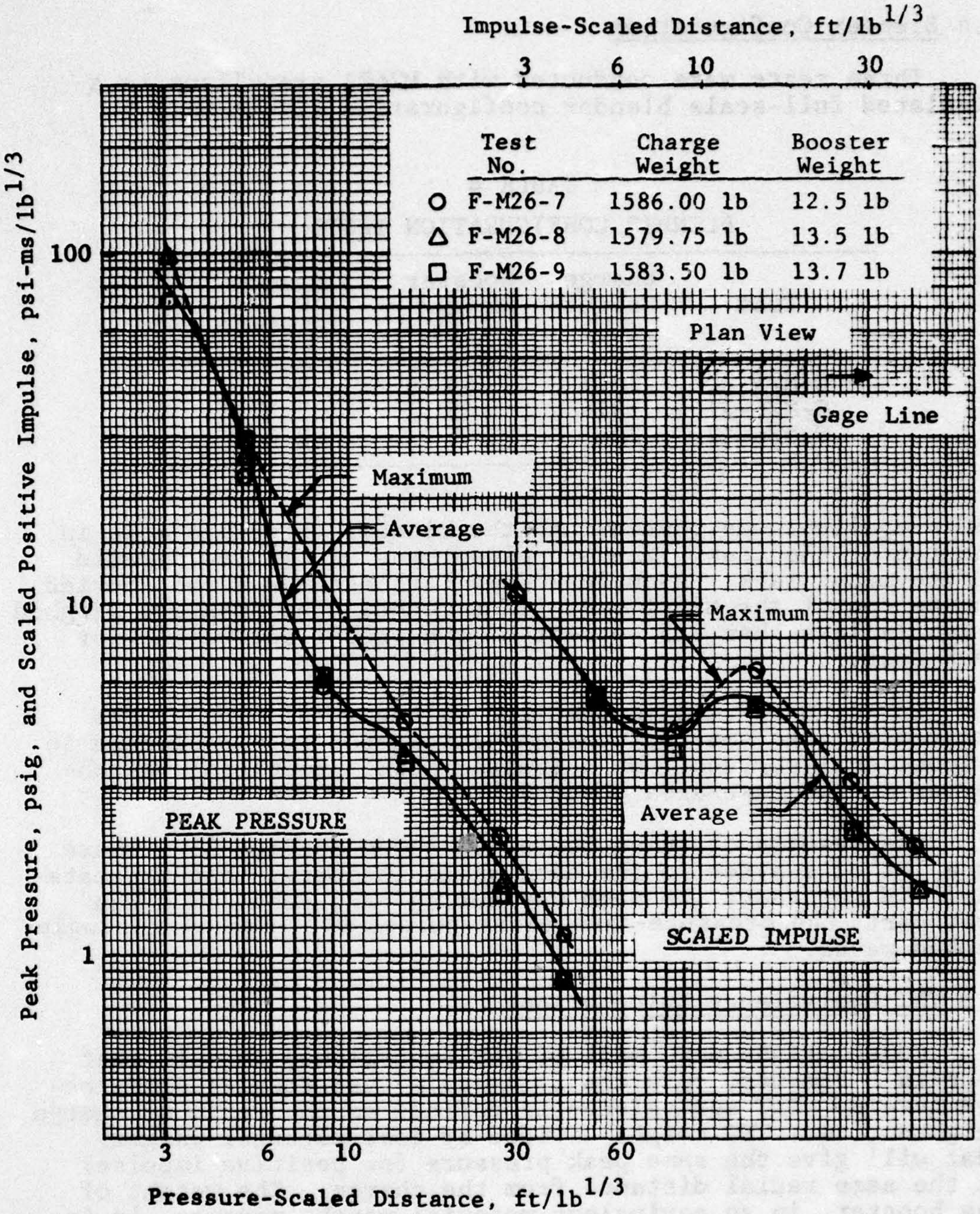


Fig. 24 PRESSURE AND SCALED IMPULSE, FULL-SCALE DRYER BED CONFIGURATION, MEASURED NORMAL TO SHORT SIDE

3.4 Blender Configuration

Three tests were conducted with M26E1 propellant in a simulated full-scale blender configuration (Table 4).

TABLE 4

BLENDER CONFIGURATION TESTS

Test	Charge Weight (lb)	Booster Weight (lb)	W_B/W_C (percent)
G-M26-10	1911	45	2.4
G-M26-11	1914	45	2.4
G-M26-12	2043	45	2.2

The propellant was poured into the blender through a hole in the top of the tank. The propellant was allowed to pyramid in the metal tank. A cubical Comp C4 booster was then buried in the top of the M26E1 propellant mound. The boosters weighed slightly less than 2.5 percent of the propellant weight for each test.

During each test in this series, the metal blender was fragmented into small pieces and large craters were formed in a loose soil surface. No unignited M26E1 propellant was observed in the test area posttest.

The results of these tests are shown in Fig. 25. There is a lot of scatter in the data which indicates that the material did not react the same way during each test. For the most part, the pressure-time blast pulses measured were single-peaked waves.

3.5 TNT Equivalency Calculations

Calculations were made of TNT equivalency for all test results. However, only the full-scale test results are plotted herein. TNT equivalency is defined as the ratio of charge weights (i.e., TNT weight divided by test material weight) that will give the same peak pressure (or positive impulse) at the same radial distance from the charge. The weight of the booster, in an equivalent material weight measure, is included in the total charge weight during the computational procedure.

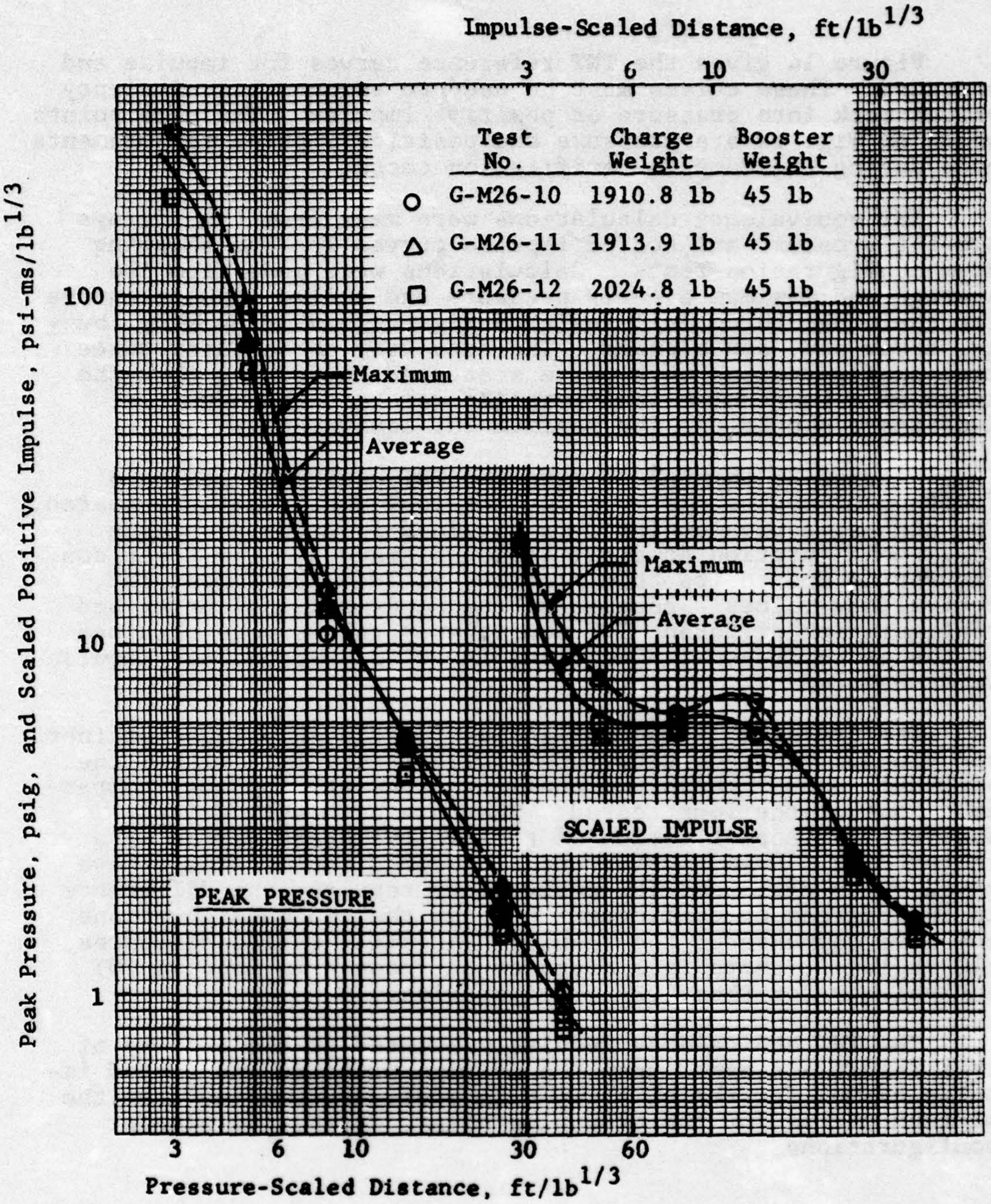


Fig. 25 PRESSURE AND SCALED IMPULSE, FULL-SCALE BLENDER CONFIGURATION

Figure 14 gives the TNT reference curves for impulse and pressure. These curves must be used to reconvert equivalency values back into pressure or positive impulse. The data points shown on Fig. 14 are pressure and positive impulse measurements made during the Comp C4 verification tests.

TNT equivalency calculations were made from the average eye-fit pressure and scaled impulse curves for the shipping drum configuration tests. Calculations were made from the average and maximum eye-fit pressure and scaled impulse curves for the other three full-scale configurations: drop plug buggy, dryer bed, and blender. The data from these later three test configurations were quite scattered indicating that the tests on a particular configuration were not reproducible. A designer should use the maximum TNT equivalencies.

Figures 26 through 30 give the TNT equivalencies as a function of scaled distance for the four configurations tested. The highest equivalencies were obtained from the drop plug buggy configuration at small scaled distances. The dryer configuration due to its thin profile, yielded the lowest TNT equivalency values. Because of the nonsymmetrical dryer bed configuration, different TNT equivalency values were obtained in the two orthogonal directions in which pressure and impulse were measured.

The pressure TNT equivalencies for the shipping container and blender configurations are similar; they fall within the same data band. These two configurations are the most comparable ones of the four tested. They are both cylindrical. However, the aspect ratios of the two cylinders varied by a factor of 2.6. This difference in aspect ratios should have given quite different TNT equivalency results; the difference in the degrees of confinement between the two configurations may have compensated the results. At small scaled distances, <10 ft/lb$^{1/3}$, there is a distinct difference in impulse TNT equivalency for these two configurations.

The TNT equivalency results presented in the summary of this report are based upon the average pressure and scaled impulse curves for the shipping drum configuration and upon the maximum curves for the drop plug buggy, dryer, and blender configurations.

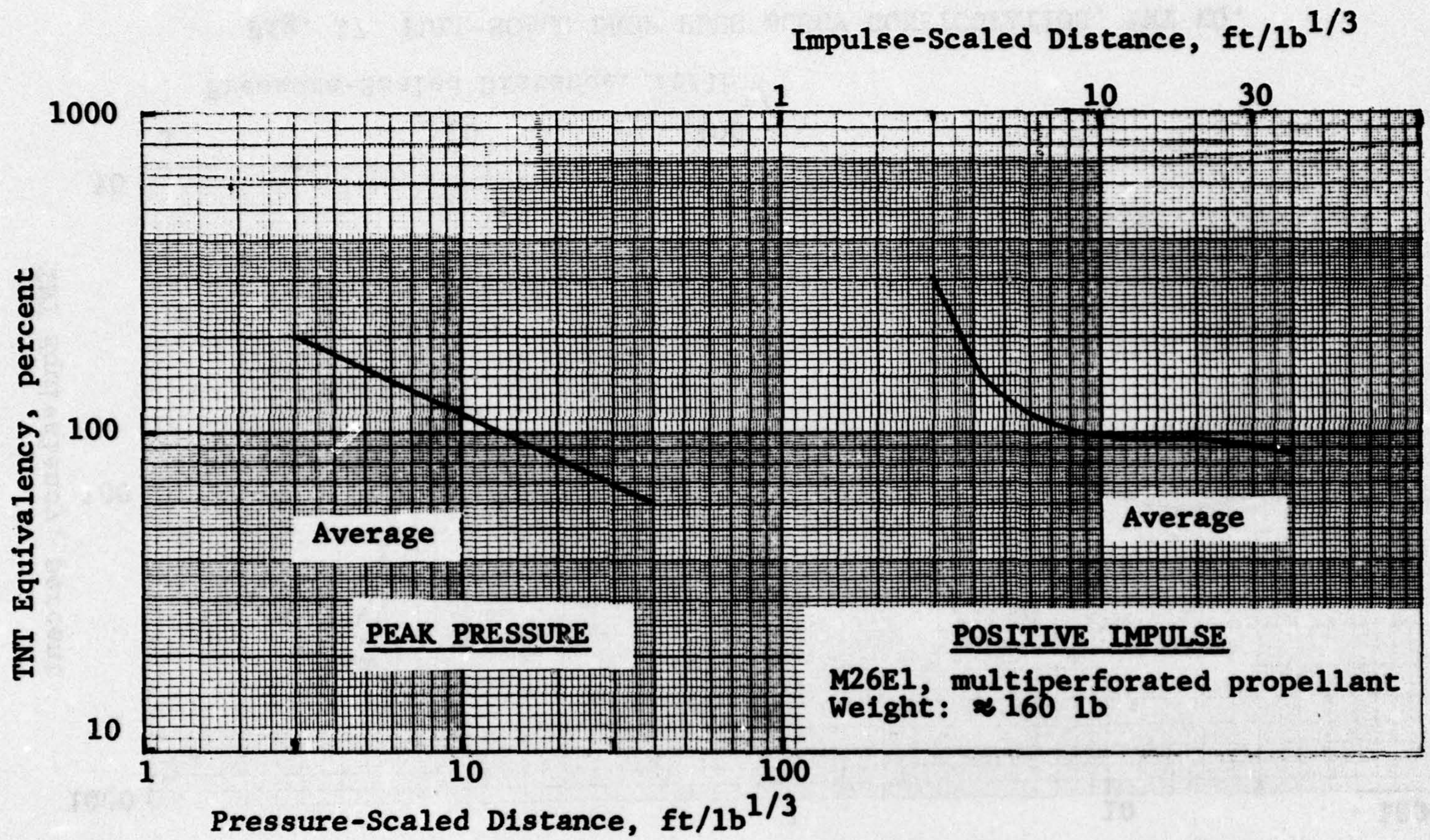


Fig. 26 FULL-SCALE SHIPPING DRUM CONFIGURATION, TNT EQ.

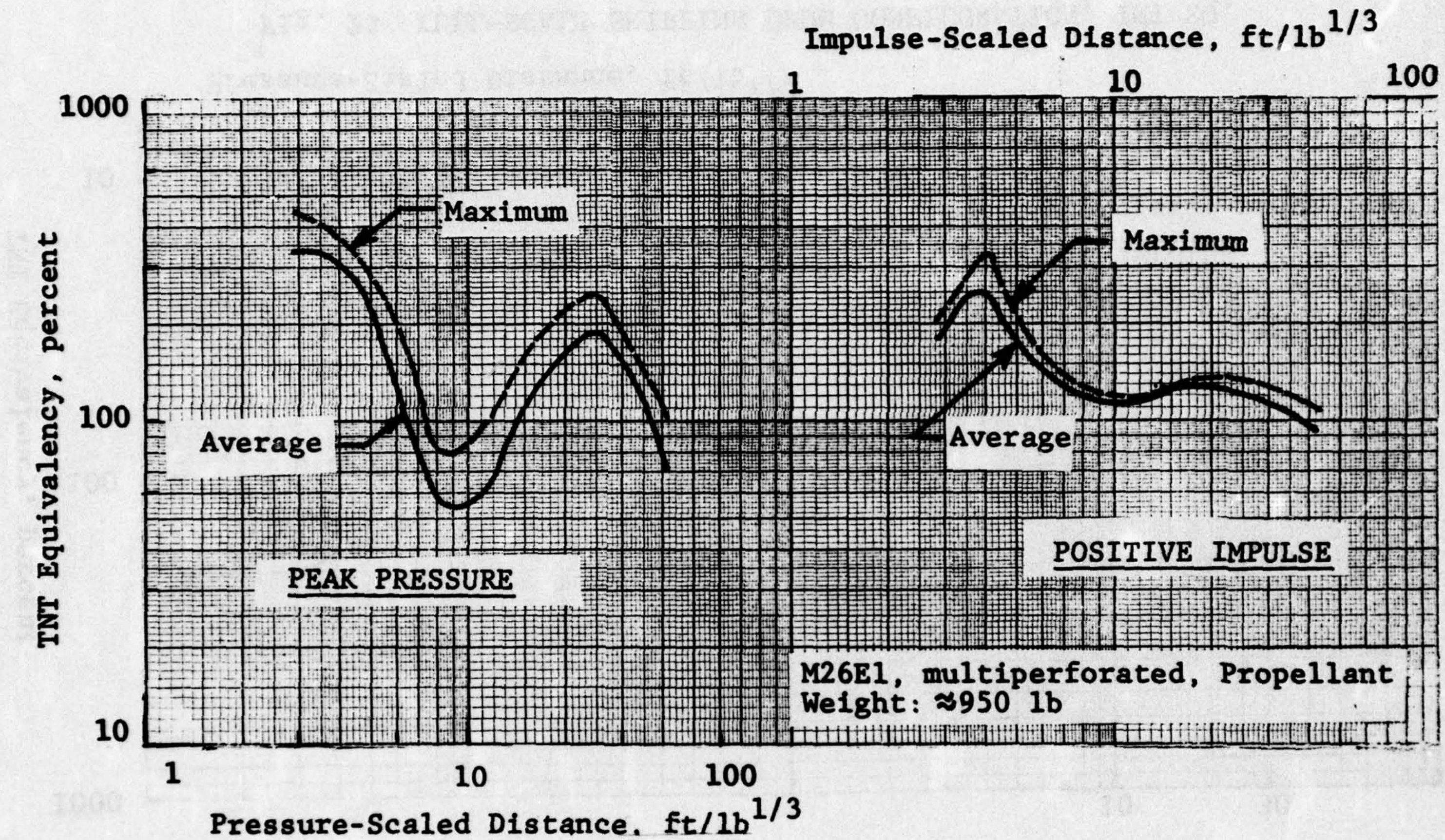


Fig. 27 FULL-SCALE DROP PLUG BUGGY CONFIGURATION, TNT EQ.

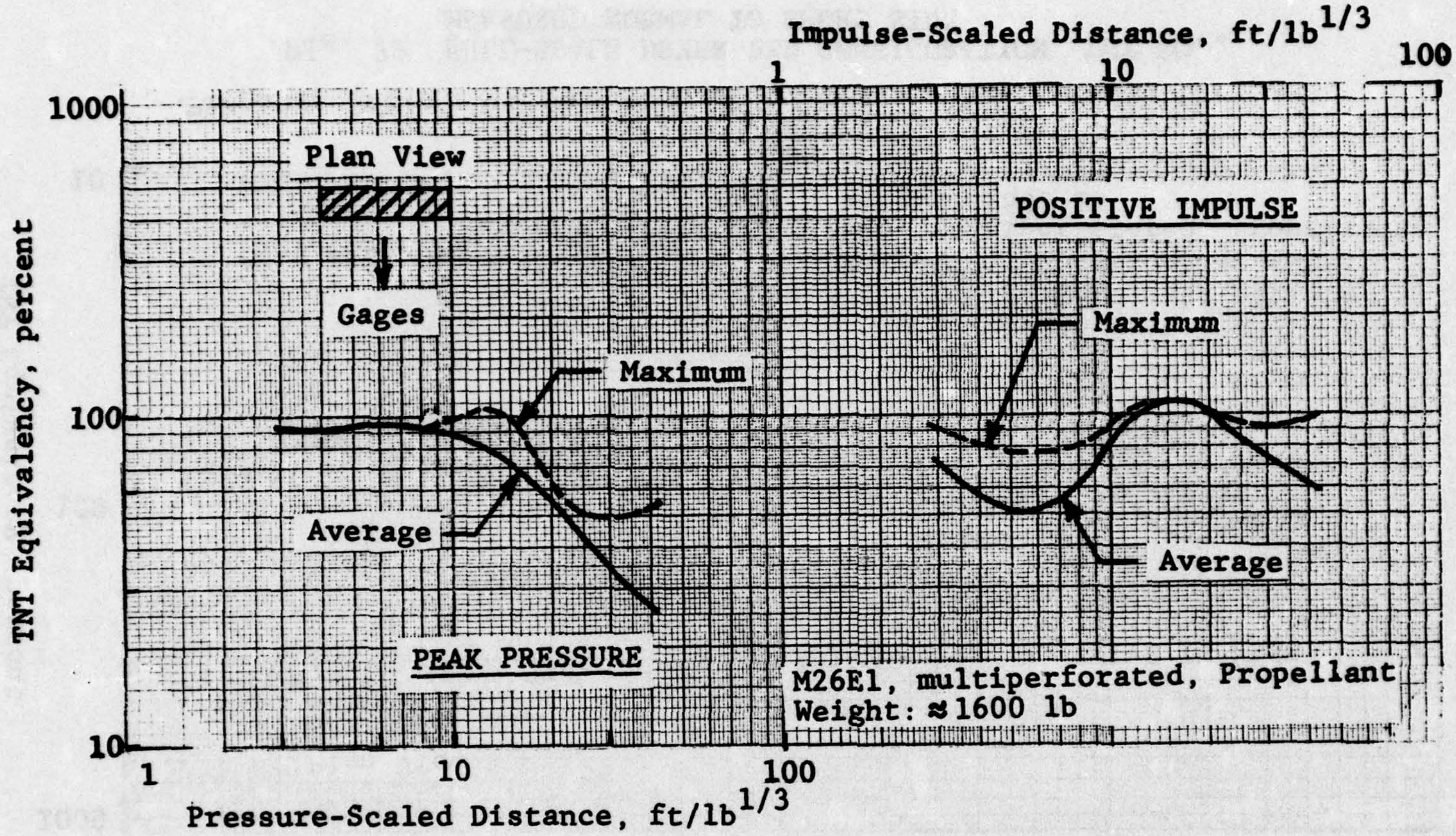


Fig. 28 **FULL-SCALE DRYER BED CONFIGURATION, TNT EQ.,** *MEASURED NORMAL TO LONG SIDE*

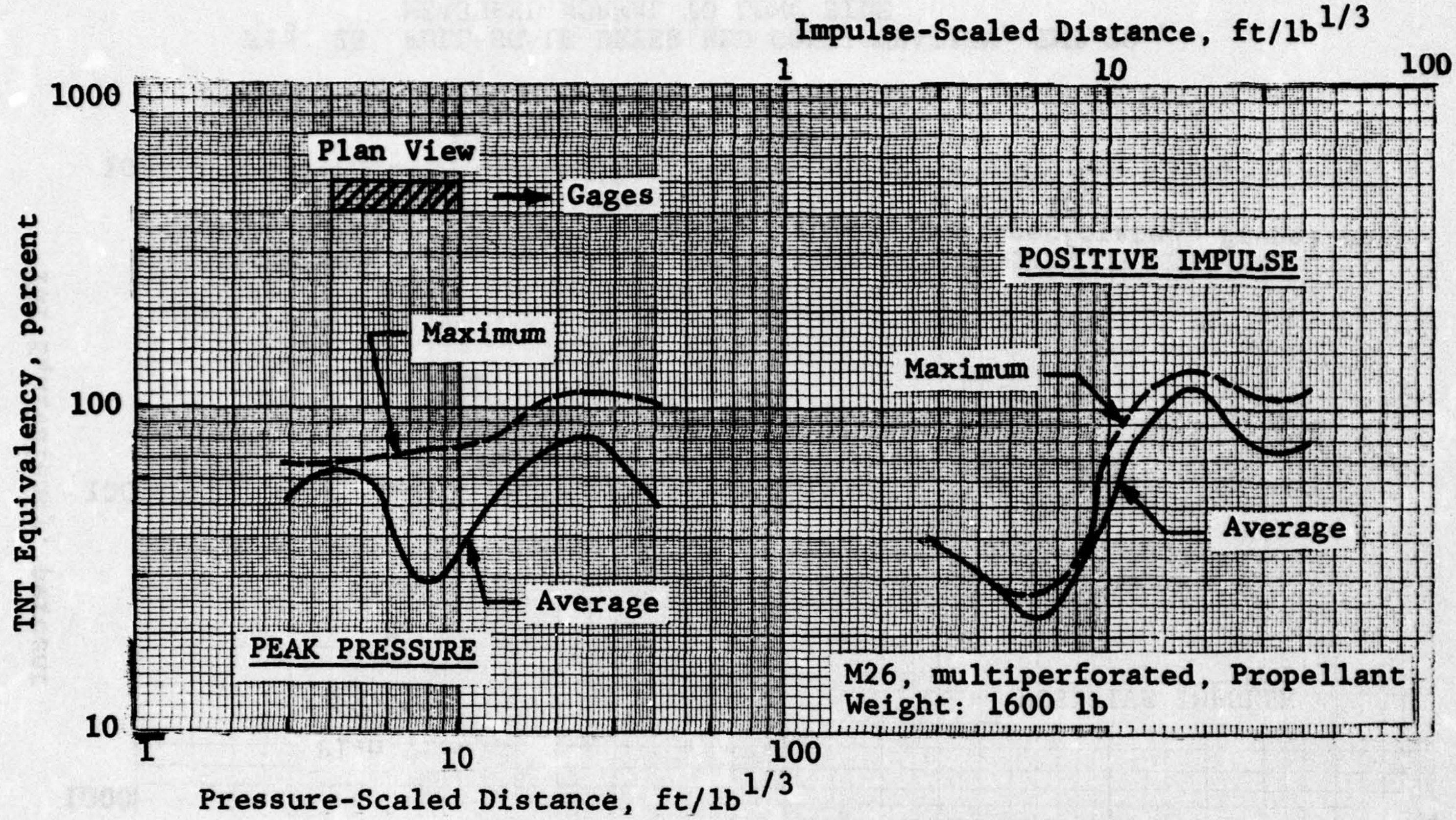


Fig. 29 FULL-SCALE DRYER BED CONFIGURATION, TNT EQ., MEASURED NORMAL TO SHORT SIDE

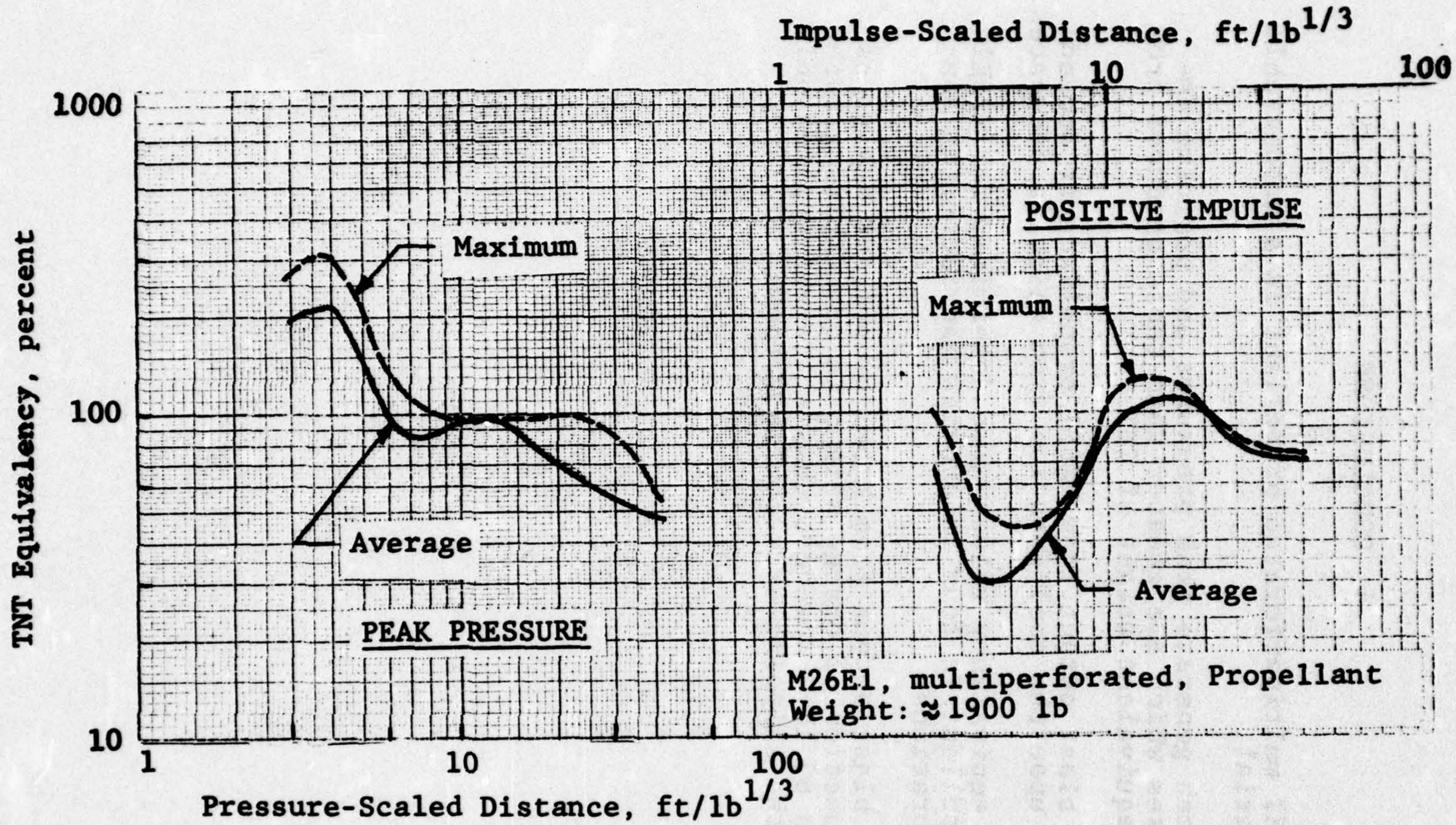


Fig. 30 FULL-SCALE BLENDER CONFIGURATION, TNT EQ.

4. CONCLUSIONS

1. M26E1 multiperforated propellant is a detonatable material.

2. It can generate peak pressures and positive impulses which are greater than those produced from an equivalent weight of TNT.

3. The blast output from M26E1 propellant is dependent upon the configuration from which it detonates.

4. TNT equivalency values were determined for M26E1 propellant in four in-process manufacturing configurations.

5. The blast output from M26E1 propellant scales as a function of charge weight in quantities greater than 65 lb. However, this statement applies only to the shipping drum configuration.

APPENDIX A

FIELD DATA SHEETS

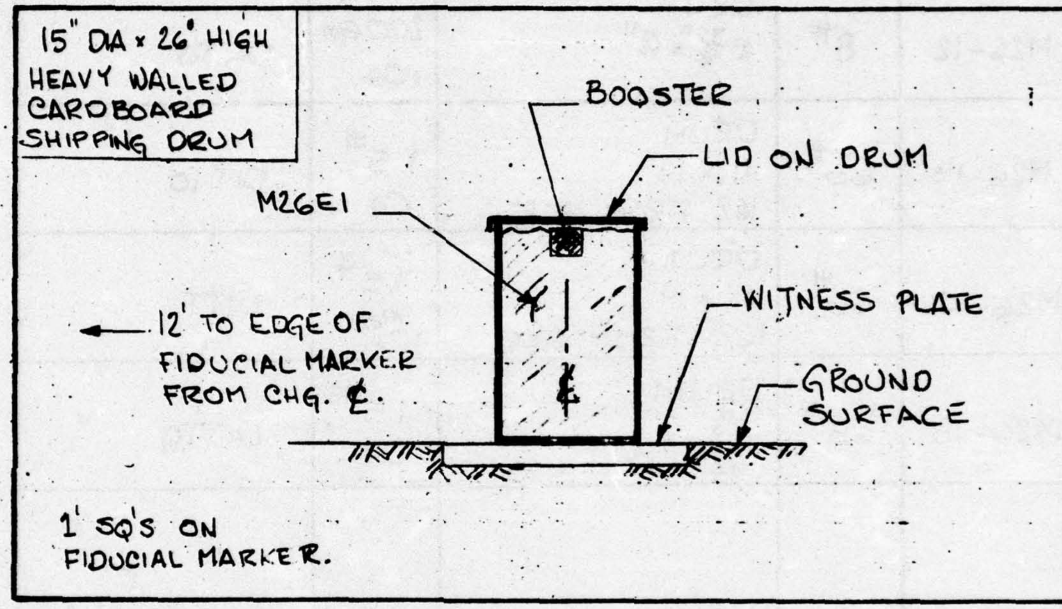
TEST MATERIAL M26E1 MULTIPERFORATED

TEST NO.	CHARGE WEIGHT	CONFIGURATION	BOOSTER WEIGHT	COMMENTS
M26-1	50#	DRUM 11"x19"	100 gm C4	UNBURNT M26E1. WITNESS ℗ BENT.
M26-2	50#	DRUM 11"x19"	200gm C4	UNBURNT M26E1. WITNESS ℗ FRAGMENTED.
M26-3	50#	DRUM 11"x19"	400gm C4	UNBURNT M26E1. WITNESS ℗ FRAGMENTED.
M26-4	65#	DRUM 11"x19" FULL	1.5# C4	NO UNBURNT M26. WITNESS ℗ FRAGMENTED.
M26-5	65#	DRUM 11"x19"	1.5# C4	DITTO
M26-6	65#	DRUM 11"x19"	1.5# C4	DITTO
M26-7	65#	DRUM 11"x19"	1.5# C4	DITTO
M26-8	39#	DRUM 9½"x15¼"	400gm C4	DITTO
M26-9	39#	DRUM 9½"x15¼"	400 gm C4	DITTO
M26-10	8#	DRUM 5¾"x9"	100 gm C4	UNBURNT M26E1

TEST MATERIAL M26E1 MULTIPERFORATED

TEST NO.	CHARGE WEIGHT	CONFIGURATION	BOOSTER WEIGHT	COMMENTS
M26-11	8#	DRUM 5 3/4" x 9"	200 Gm C4	NO UNBURNT M26. WITNESS PL FRAGMENTED.
M26-12	8#	DRUM 5 3/4" x 9"	200 Gm C4	DITTO
M26-13	65#	DRUM 11" x 19" 162' FROM G6E	1.5# C4	DITTO
M26-14	65#	DRUM 11" x 19" 162' FROM G6E	1.5# C4	DITTO
M26-15	65#	DRUM 11" x 19" 162' FROM G6E	1.5# C4	DITTO

IITRI PROJECT NO. J6342	DATA SHEET NO.
TEST TITLE A-M26-1 SHIPPING DRUM	DATE 4-15-75
TEST SAMPLE M26E1 (.038 WEB MP GRAIN)	TIME 1010 HRS.
SAMPLE WEIGHT 158 1/2 LB.	TEMP 51 °F
IGNITER 2-ENGINEER SPECIALS (#8)	HUMID 37%
BOOSTER 4 LB. C4 BLOCK ≈ 4" CUBE	BARO 25.43 IN. HG.
HIGH SPEED CAMERA (1000 cps) YES (MISSED)	WIND 190° @ 10 KNOTS



FIELD EVALUATION:

APPARENT CRATER SIZE: ≈ 6' DIA. x 8" DEPTH.

WITNESS PLATE FRAGMENTED.

NO UNIGNITED M26E1 OBSERVED IN AREA POST-TEST.

IITRI PROJECT NO. J6342 DATA SHEET NO. ____

TEST TITLE A-M26-2 SHIPPING DRUM DATE 4-17-75

TEST SAMPLE M26E1 (.038 WEB MP GRAIN) TIME 1140 HRS.

SAMPLE WEIGHT 158 1/4 LB. TEMP 36°F

IGNITER 2-ENGINEER SPECIALS (#8) HUMID 82%

BOOSTER 4 LB C4 BLOCK, ≈4" CUBE BARO 25.30 IN. HG.

HIGH SPEED CAMERA (1000 cps) YES (MISSED) WIND 310° @ 7KNOTS

SAME TEST CONFIGURATION AS TEST A-M26-1.

EDGE OF FIDUCIAL MARKER 8' FROM CHARGE ℄.

GROUND VERY MUDDY AFTER A SNOW FALL.

FIELD EVALUATION:

APPARENT CRATER SIZE: ≈ 8 1/2' DIA. x 20" DEPTH.

WITNESS PLATE FRAGMENTED.

NO UNIGNITED M26E1 OBSERVED IN AREA POSTTEST.

IITRI PROJECT NO. J6342 DATA SHEET NO. ____

TEST TITLE A.M26-3 SHIPPING DRUM DATE 4-17-75

TEST SAMPLE M26E1 (.038 WEB MP GRAIN) TIME 1329 HRS.

SAMPLE WEIGHT 158 1/4 LB. TEMP 37°F

IGNITER 2-ENGINEER SPECIALS (#8) HUMID 92%

BOOSTER 4 LB. C4 BLOCK. ≈ 4" CUBE. BARO 25.30 IN.HG.

HIGH SPEED CAMERA (1000 cps) YES WIND 290° @ 11 KNOTS

SAME TEST CONFIGURATION AS TEST A-M26-1.

EDGE OF FIDUCIAL MARKER 8' FROM CHARGE ℄.

GROUND NOT AS MUDDY AS PREVIOUS M26-2 SHOT.

FIELD EVALUATION:

APPARENT CRATER SIZE: ≈ 6 1/2' DIA. x 6"-7" DEPTH.

WITNESS PLATE FRAGMENTED.

NO UNIGNITED M26E1 OBSERVED IN AREA POST-TEST.

IITRI PROJECT NO. J6342 **DATA SHEET NO.** ____

TEST TITLE E-M26-4 DROP PLUG BUGGY **DATE** MAY 20, 1975

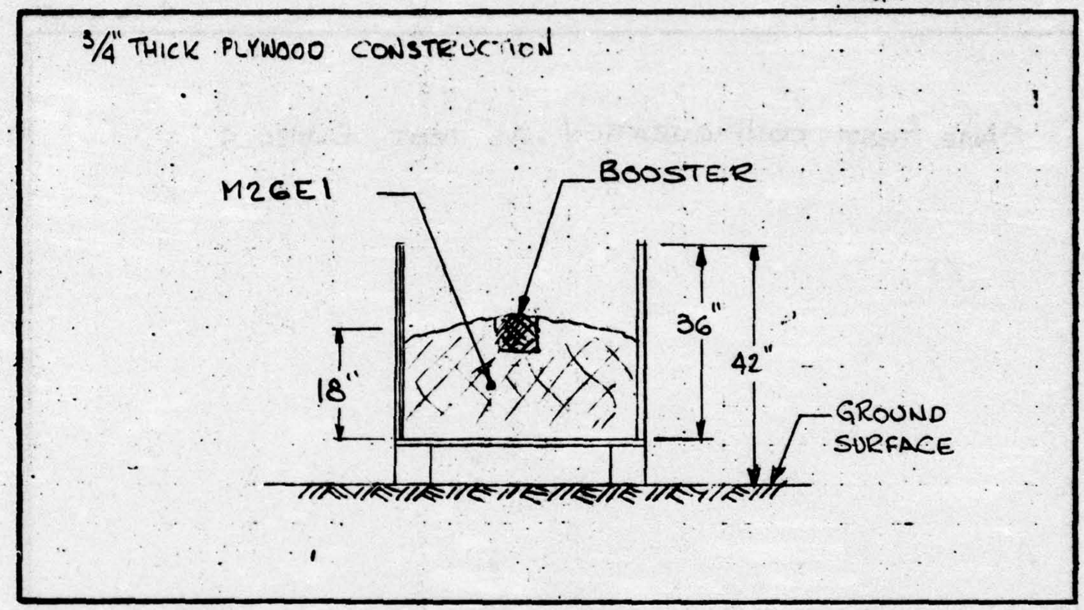
TEST SAMPLE M26E1 (.038 WEB MP GRAIN) **TIME** 1432 HRS.

SAMPLE WEIGHT 951 3/4 LB. **TEMP** 35°F

IGNITER 2 ENGINEER SPECIALS (#8) **HUMID** 69%

BOOSTER 25 LB. C4 BLOCK ≈ 7 1/2" CUBE **BARO** 25.16 IN. HG

HIGH SPEED CAMERA (1000 cps) YES **WIND** 34° @ 13 KNOTS LIGHT SNOW



FIELD EVALUATION:

APPARENT CRATER SIZE: ≈16' DIA. x 4' DEPTH

DETONATION

NO UNBURNT M26E1 OBSERVED IN AREA POST-TEST.

IITRI PROJECT NO. J6342 DATA SHEET NO. ____

TEST TITLE E.M26-5 DROP PLUG BUGGY DATE MAY 21, 1975

TEST SAMPLE M26E1 (.038 WEB MP GRAIN) TIME 1055

SAMPLE WEIGHT 944¼ LB ≈960# TEMP 38°F

IGNITER 2- ENGINEER SPECIALS (#8) HUMID 61%

BOOSTER 25 LB. C4 BLOCK ≈ 7½" CUBE BARO 25.366

HIGH SPEED CAMERA (1000 cps) YES WIND 180° @ 10 KNOT

4 15 KNOTS

SAME TEST CONFIGURATION AS TEST E-M26-4.

FIELD EVALUATION:

APPARENT CRATER SIZE: 16' DIA. x ≈ 38" DEPTH.

DETONATION

NO UNBURNT M26E1 OBSERVED IN AREA POSTTEST.

IITRI PROJECT NO. J6342

DATA SHEET NO. ____

TEST TITLE E-M26.6 DROP PLUG BUGGY

DATE MAY 21, 1975

TEST SAMPLE M26E1 (.038 WEB MP GRAIN)

TIME 1310 HRS

SAMPLE WEIGHT 955 1/2 LB.

TEMP 36°F

IGNITER 2- ENGINEER SPECIALS (#8)

HUMID 63%

BOOSTER 25 LB. C4 BLOCK, ≈ 7 1/2" CUBE

BARO 25.345

HIGH SPEED CAMERA (1000 cps) YES

WIND 170 @ 12 KNOTS

SAME TEST CONFIGURATION AS TEST E-M26.4

FIELD EVALUATION:

APPARENT CRATER DEPTH: ≈17' DIA. X ≈ 40" DEPTH

DETONATION

NO UNBURNT M26E1 OBSERVED IN AREA POST-TEST.

TEST MATERIAL M26E1 MULTIPERFORATED

TEST NO.	CHARGE WEIGHT	CONFIGURATION	BOOSTER WEIGHT	COMMENTS
M26-B1	58#	DRYER 17"x17"x6"DEPTH	1.5# C4 CONE	
M26-B2	60#	DRYER 7¾"x 38¼"x6"DEPTH	1.5# C4 CONE	
M26-B3	59.5#	DRYER 10¾"x 53¾"x3"DEPTH	1.5# C4 CONE	UNBURNT M26E1.

IITRI PROJECT NO. 16342 DATA SHEET NO.

TEST TITLE F-M26-7 DRYER BED DATE MAY 23, 1975

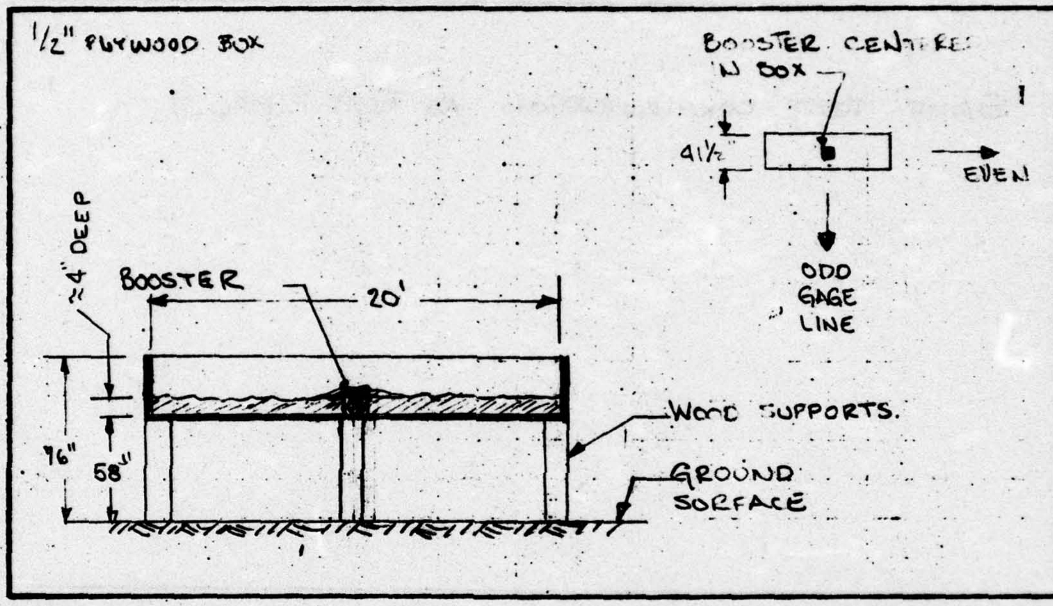
TEST SAMPLE M26E1 (.038 WEB MP GRAIN) TIME 1023 HRS.

SAMPLE WEIGHT 1586 LBS TEMP 51°F

IGNITER 2 - ENGINEER SPECIALS (#8) HUMID 52%

BOOSTER 12.5 LB C4 BLOCK, 6 INCH CUBE BARO 25.59 IN. HG

HIGH SPEED CAMERA (1000 cps) YES WIND 15° @ 7 KNOTS



FIELD EVALUATION:

APPARENT CRATER SIZE ≈ 28' LONG x 8' WIDE x 2' DEEP.

CONSIDERABLE BACK FILL IN MIDDLE.

DETONATION.

NO UNBURNT M26E1 OBSERVED POST-TEST.

BOX DISINTEGRATED

IITRI PROJECT NO. 16342 DATA SHEET NO. ____

TEST TITLE F-M26-8 DRYER BED DATE JUNE 2, 1975

TEST SAMPLE M26E1 (.088" WEB MP GRAIN) TIME 1325 HRS.

SAMPLE WEIGHT 1597 3/4 LB. TEMP 86°F

IGNITER 2 ENGINEER SPECIALS (#8) HUMID 14%

BOOSTER 13.5 LB. C4 BLOCK, ≈ 6 INCH CUBE BARO 25.43 IN. HG

HIGH SPEED CAMERA (1000 cps) ____ WIND 18° @ 12 KNOTS

SAME TEST CONFIGURATION AS TEST F-M26-7

FIELD EVALUATION:

APPARENT CRATER SIZE: ≈ 28 1/2' LONG × 8 1/2' WIDE × ≈ 14" DEEP.

A LOT OF BACK FILL IN MIDDLE.

DETONATION.

BOX FRAGMENTED, DISINTEGRATED

NO UNBURNT M26E1 OBSERVED POST-TEST.

IITRI PROJECT NO. J6342 DATA SHEET NO. ____

TEST TITLE F-M26-9 DRYER BED DATE JUNE 2, 1975

TEST SAMPLE M26E1 (.038" WEB MP GRAIN TIME 1146 HRS.

SAMPLE WEIGHT 1583½ LB. TEMP 86°F

IGNITER 2-ENGINEER SPECIALS (#8) HUMID 14%

BOOSTER 13.7 LB. C4 BLOCK, ≈ 6 INCH CUBE BARO 25.43 IN.HG

HIGH SPEED CAMERA (1000 cps) ____ WIND 18° @ 12 KNOTS

SAME TEST CONFIGURATION AS TEST F-M26-7

FIELD EVALUATION:

APPARENT CRATER SIZE: ≈ 29' LONG x ≈ 9' WIDE x 18" DEPTH.

CENTER BACKFILLED.

DETONATION

BOX DISINTEGRATED.

NO UNBURNT M26E1 OBSERVERED POST-TEST.

IITRI PROJECT NO. 16342

DATA SHEET NO. ____

TEST TITLE G. M26-10 BLENDER

DATE JUNE 3, 1975

TEST SAMPLE M26E1 (.038" WEB MP GRAIN)

TIME 1106 HRS.

SAMPLE WEIGHT 1910 8/10 LB

TEMP 66°F

IGNITER 2 ENGINEER SPECIALS (#8)

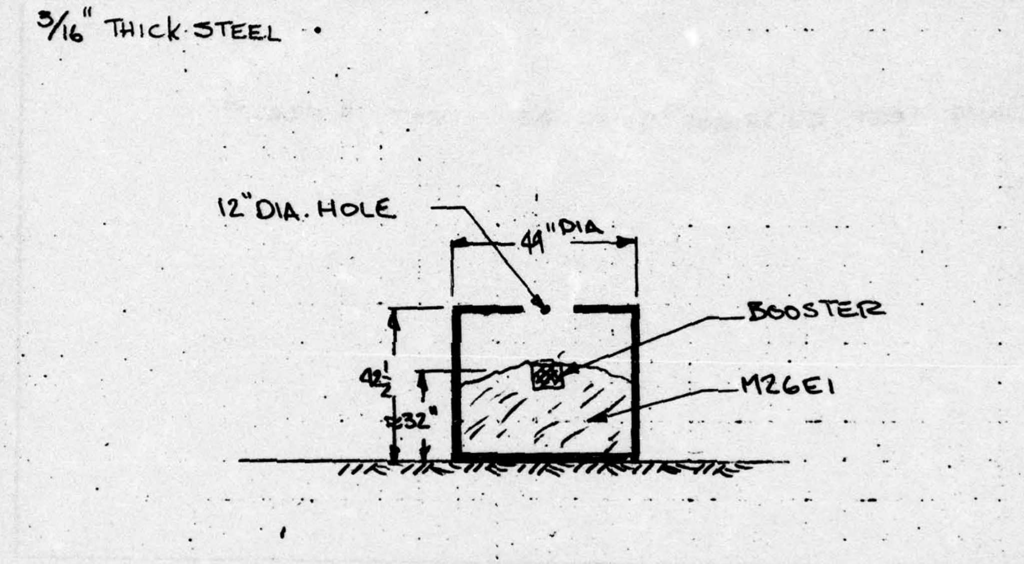
HUMID 37%

BOOSTER 45 LB CA CUBE ≈ 9 1/4" CUBE

BARO 25.45 IN. HG

HIGH SPEED CAMERA (1000 cps) YES

WIND 31° @ 5 KNOTS



FIELD EVALUATION:

APPARENT CRATER SIZE: ≈21' DIA x ≈ 4 1/2' DEPTH.

DETONATION

NO UNBURNT M26E1 OBSERVED POST-TEST.

BLENDER FRAGMENTED INTO SMALL PIECES.

IITRI PROJECT NO. J6342 | DATA SHEET NO. ____
TEST TITLE G-M26-11 BLENDER | DATE JUNE 3, 1975
TEST SAMPLE M26E1 (.038" WEB MP GRAIN) | TIME 1414 HRS
SAMPLE WEIGHT 1913 9/10 LB | TEMP 68°F
IGNITER 2 ENGINEER SPECIALS (#8) | HUMID 29%
BOOSTER 45 LB C4 CUBE | BARO 25.44 IN. HG.
HIGH SPEED CAMERA (1000 cps) YES | WIND 2° @ 10 KNOTS

SAME TEST CONFIGURATION AS TEST G-M26-10

FIELD EVALUATION:

APPARENT CRATER SIZE: ≈21' DIA. x 4' DEPTH

DETONATION

NO UNBURNT M26E1 OBSERVED POST-TEST.

BLENDER FRAGMENTED INTO SMALL PIECES.

IITRI PROJECT NO. J6342 | DATA SHEET NO. ____
TEST TITLE G-M6-12 BLENDER | DATE JUNE 4 1975
TEST SAMPLE M26E1 (.038" WEB MP GRAIN) | TIME 1400 HRS.
SAMPLE WEIGHT 2042 8/10 LB. | TEMP 68°F
IGNITER 2 - ENGINEER SPECIALS (#8) | HUMID 23%
BOOSTER 45 LB. C4 CUBE ≈ 9 1/4" CUBE | BARO 25.57 IN. HG.
HIGH SPEED CAMERA (1000 cps) ____ | WIND 30° @ 5 KNOTS

SAME TEST CONFIGURATION AS TEST G-M26-10

30
4E
7E

FIELD EVALUATION:

APPARENT CRATER SIZE: ≈ 21' DIA. x 3 1/2' DEPTH

DETONATION

BLENDER FRAGMENTED INTO SMALL PIECES.

NO UNBURNT M26E1 OBSERVED IN AREA POST-TEST.

APPENDIX B

TEST DATA

TEST DATA

R (FT)	P (PSIG)	I (PSI-MS)
M26-1 50LBS (100GM) CYLINDER L/D =1.7		
8.75	75.50	26.20
8.79	85.30	35.10
11.92	45.90	30.40
11.98	39.80	29.70
16.94	17.30	13.10
16.98	20.80	17.30
26.97	9.94	16.40
27.00	10.30	16.70
39.47	4.49	11.10
39.73	4.15	11.40
80.68	1.44	6.50
80.71	1.32	5.66
M26-2 50LBS (200GM) CYLINDER L/D =1.7		
8.75	160.00	- -
8.79	340.00	- -
11.72	116.00	76.60
11.98	154.00	76.40
16.94	62.90	22.10
16.98	66.20	40.60
26.97	15.80	28.80
27.00	14.10	31.50
39.47	7.68	21.60
39.73	7.21	21.50
80.68	2.44	12.50
80.71	2.12	10.60
M26-3 50LBS (400GM) CYLINDER L/D =1.7		
8.75	349.00	- -
8.79	529.00	99.70
11.72	192.00	82.70
11.98	264.00	119.00
16.94	94.90	26.80
16.98	104.00	33.40
26.97	22.80	32.50
27.00	24.50	30.50
39.47	7.66	26.80
39.73	6.97	19.50
80.68	2.44	12.60
80.71	2.29	13.30

TEST DATA

M26-4 65 LBS (1.5 LB) CYLINDER L/D = 1.7

R (FT)	P (PSIG)	I (PSI-MS)
9.32	564.00	94.70
12.00	306.00	102.00
12.37	304.00	109.00
14.91	118.00	72.90
17.25	135.00	70.70
27.17	29.60	49.00
39.61	8.58	25.60
42.93	8.48	22.90
80.75	2.66	13.40
83.92	2.69	14.40

M26-5 65 LBS (1.5 LB) CYLINDER L/D = 1.7

R (FT)	P (PSIG)	I (PSI-MS)
9.32	523.00	89.90
12.00	225.00	101.00
12.37	258.00	121.00
14.91	172.00	70.50
17.25	91.10	69.50
20.17	87.00	55.60
27.17	33.70	41.10
30.17	18.00	28.10
39.61	9.23	25.50
42.93	8.23	24.30
80.75	2.65	12.80
83.92	2.52	13.40

M26-6 65 LBS (1.5 LB) CYLINDER L/D = 1.7

R (FT)	P (PSIG)	I (PSI-MS)
9.32	541.00	78.10
12.00	272.00	101.00
12.37	299.00	103.00
14.91	176.00	83.00
17.25	92.40	78.80
20.17	79.90	49.00
27.17	26.70	39.40
30.17	38.00	27.60
39.61	9.87	26.00
42.93	8.56	22.90
80.75	2.65	13.20
83.92	2.47	14.30

TEST DATA

R (FT)	P (PSIG)	I (PSI-MS)
M26-7 65 LBS (1.5 LB) CYLINDER L/D = 1.7		
9.32	467.00	- -
12.00	251.00	83.00
12.37	309.00	- -
14.91	110.00	73.80
17.25	106.00	90.00
20.17	72.30	51.50
27.17	28.20	44.30
30.17	19.10	27.60
39.61	9.28	25.40
42.93	8.22	24.50
80.75	2.67	13.60
83.92	2.50	14.50
M26-13,14,15 65 LBS (1.5 LBS) CYLINDER L/D = 1.7		
85.69	2.95	11.90
85.69	2.91	11.70
85.69	2.49	11.30
90.51	2.63	13.10
90.51	2.62	12.70
90.51	2.38	12.50
108.30	1.95	11.30
108.30	1.89	11.30
108.30	1.74	11.00
114.60	1.62	10.30
114.60	1.57	10.00
114.60	1.51	7.89
120.50	1.42	8.40
120.50	1.42	8.40
120.50	1.32	7.91
162.00	.99	7.20
162.00	.98	7.10
162.00	.86	6.90
M26-8 39 LBS (400GM) CYLINDER L/D = 1.7		
8.75	339.00	109.00
8.79	362.00	113.00
11.72	151.00	73.00
11.98	167.00	67.70
16.94	66.50	42.10
16.98	45.30	49.90
26.97	16.20	27.50
27.00	13.70	24.30
39.47	5.75	17.00
39.73	6.61	19.30
80.68	1.86	9.12
80.71	1.78	8.84

TEST DATA

R (FT)	P (PSIG)	I (PSI-MS)
M26-9 39 LBS (400GM) CYLINDER L/D = 1.7		
8.75	242.00	106.00
8.79	369.00	82.20
11.72	158.00	66.70
11.98	192.00	84.20
16.94	62.50	42.40
16.98	37.10	42.50
26.97	17.70	27.30
27.00	14.70	24.40
39.47	5.93	16.80
39.73	6.90	19.30
80.68	1.81	9.18
80.71	1.72	9.18
M26-10 8 LBS (100GM) CYLINDER L/D = 1.7		
8.75	34.30	25.50
8.79	32.60	15.70
11.72	13.50	14.50
11.98	14.80	15.50
16.94	10.24	10.60
16.98	11.40	10.10
26.97	4.52	7.71
27.00	4.29	7.19
39.47	2.00	4.53
39.73	2.07	4.39
80.68	.75	2.27
80.71	.73	2.24
M26-11 8 LBS (200GM) CYLINDER L/D = 1.7		
8.75	85.60	36.70
8.79	44.40	20.50
11.72	21.20	21.20
11.98	24.60	18.50
16.94	11.30	12.80
16.98	12.90	14.60
26.97	5.66	9.32
27.00	5.58	8.29
39.47	2.35	5.43
39.73	2.37	5.97
80.68	.82	2.82
80.71	.81	2.65

TEST DATA

R	P	I
(FT)	(PSIG)	(PSI-MS)
M26-12 8 LBS (200GM) CYLINDER L/D = 1.7		
8.75	47.50	26.80
8.79	44.40	22.80
11.72	22.90	18.00
11.98	23.70	17.50
16.94	10.80	10.80
16.98	11.50	13.30
26.97	6.54	9.69
27.00	5.66	9.74
39.47	2.61	5.66
39.73	2.55	6.27
80.68	.89	2.71
80.71	.86	2.67

TEST DATA

R (FT)	P (PSIG)	I (PSI-MS)
M26-B1 56 LBS (1.5 LB) 17"X17"X6"		
8.78	311.00	48.50
8.86	358.00	113.00
11.77	136.00	94.90
11.97	159.00	127.00
16.96	73.80	59.60
17.03	47.50	69.00
26.99	16.90	33.00
27.03	19.10	27.40
39.49	6.66	25.10
39.79	6.64	24.40
80.69	2.13	14.30
80.78	2.01	15.10
M26-B2N 60 LBS (1.5 LB) 7.5"X38"X6"		
8.86	483.00	94.70
11.77	255.00	129.00
17.03	128.00	66.10
27.03	27.00	39.30
39.79	10.40	27.40
80.78	2.62	14.10
M26-B2E 60 LBS (1.5 LB) 7.5"X38"X6"		
8.78	411.00	51.30
11.97	150.00	81.20
16.96	54.50	42.00
26.99	7.75	28.70
39.49	9.13	33.60
80.69	3.42	15.50
M26-B3N 59.5 LBS (1.5 LB) 10.75"X53.75"X3"		
8.86	165.00	101.00
11.77	141.00	98.20
17.03	48.60	39.40
27.03	19.70	29.40
39.79	8.29	21.90
80.78	2.07	12.00
M26-B3E 59.5 LBS (1.5 LB) 10.75"X53.75"X3"		
8.78	206.00	69.30
11.97	73.30	48.20
16.96	26.10	34.60
26.99	12.10	37.30
39.49	7.49	26.30
80.69	2.80	13.60

TEST DATA

R (FT)	P (PSIG)	I (PSI-MS)
(A)M26-1, 158.5= M26 AND 4= C4		
16.04	- -	203.00
16.09	255.00	179.00
26.04	75.90	74.10
26.09	77.00	87.00
36.04	- -	52.50
36.08	29.30	51.20
60.03	8.40	31.30
60.08	7.60	37.80
100.10	3.20	22.70
100.10	3.18	22.20
169.10	1.37	13.80
169.20	1.36	13.90
(A)M26-2, 158.25= M26 AND 4= C4		
16.04	- -	188.00
16.09	214.00	210.00
26.04	60.20	85.80
26.09	80.00	- -
36.04	25.50	64.30
36.08	25.60	- -
60.03	8.02	32.30
60.08	7.91	36.80
100.10	3.26	22.20
100.10	2.99	22.10
169.10	1.35	14.10
169.20	1.26	11.90
(A)M26-3, 158.25= M26 AND 4= C4		
16.04	231.00	221.00
16.09	224.00	199.00
26.04	64.80	99.70
36.04	28.00	62.60
36.08	30.00	- -
60.03	8.16	32.00
60.08	8.57	38.20
100.10	3.34	22.00
100.10	3.14	21.40
169.10	1.31	13.60
169.20	1.35	12.30

TEST DATA

R (FT)	P (PSIG)	I (PSI-MS)
(E)M26-4, 951.75= M26 AND 25= C		
26.04	332.00	- -
26.13	407.00	273.00
36.03	194.00	281.00
36.15	198.00	327.00
59.96	38.40	143.00
100.13	7.30	71.30
100.13	7.14	68.30
170.13	4.16	50.80
170.19	4.11	51.10
320.03	1.96	24.90
320.33	1.86	27.20
(E)M26-5, 944.25= M26 AND 25= C4		
26.04	- -	215.00
26.13	422.00	222.00
36.03	181.00	346.00
36.15	220.00	- -
60.13	35.40	130.00
100.13	5.87	73.00
100.13	5.58	68.30
170.13	5.28	51.80
170.19	2.74	50.10
320.03	1.82	26.50
320.33	1.38	27.40
(E)M26-6, 955= M26 AND 25= C4		
26.04	478.00	194.00
26.13	390.00	177.00
36.03	239.00	334.00
36.15	177.00	288.00
59.96	45.10	135.00
60.13	33.50	124.00
100.13	8.27	69.80
100.13	5.13	65.10
170.13	5.30	49.70
170.19	4.14	48.00
320.03	1.72	24.60
320.33	1.83	26.70

TEST DATA

(E)M26-70, 158= M26 AND 12.5= C4

R (FT)	P (PSIG)	I (PSI-MS)
36.06	122.00	206.00
60.04	39.20	- -
100.13	11.90	85.70
170.15	5.06	66.80
320.33	1.40	29.80
480.23	.88	21.50

(E)M26-80, 1597.75= M26 AND 13.5= C4

R (FT)	P (PSIG)	I (PSI-MS)
36.06	95.70	162.00
60.04	40.50	- -
100.13	10.80	66.40
170.15	4.35	58.80
320.33	1.28	23.50
480.23	.66	15.10

(E)M26-90, 1583.5= M26 AND 13.7= C4

R (FT)	P (PSIG)	I (PSI-MS)
36.06	120.00	171.00
60.04	38.10	- -
100.13	12.40	65.30
170.15	3.99	59.30
320.33	1.16	22.20
480.23	.59	14.20

(E)M26-7E, 158= M26 AND 12.5= C4

R (FT)	P (PSIG)	I (PSI-MS)
36.13	70.90	123.00
59.98	23.00	64.20
100.17	5.85	- -
170.02	4.60	75.90
319.90	2.16	36.90
479.67	1.13	23.80

(E)M26-8E, 1597.75= M26 AND 13.5= C4

R (FT)	P (PSIG)	I (PSI-MS)
36.13	97.70	119.00
59.98	26.40	62.00
100.17	6.13	50.70
170.02	3.61	57.70
319.90	1.55	26.10
479.67	.85	18.00

TEST DATA

R (FT)	P (PSIG)	I (PSI-MS)
(E)M26-9E, 1583.5= M26 AND 13.7= C4		
59.98	29.00	63.50
100.17	6.25	44.50
170.02	3.51	58.60
319.90	1.48	26.10
479.67	.73	18.10
(G)M26-10, 1910.8= M26 AND 45= C4		
36.06	294.00	227.00
60.04	93.40	- -
100.13	10.70	81.20
170.02	5.43	69.10
170.20	5.02	86.70
319.90	1.72	30.60
320.33	1.73	31.20
479.67	1.01	20.70
480.23	.88	19.40
(G)M26-11, 1913.9= M26 AND 45= C4		
36.06	- -	247.00
59.98	72.90	101.00
60.04	71.00	70.10
100.13	13.00	79.60
100.17	14.50	- -
170.20	5.28	74.40
319.90	2.08	31.50
320.33	1.80	29.90
479.67	1.05	20.60
(G)M26-12, 2042.8= M26 AND 45= C4		
36.06	187.00	- -
60.04	60.80	77.80
100.13	12.60	72.40
100.17	12.50	72.90
170.20	4.27	58.90
319.90	1.57	28.30
320.33	1.51	29.30
479.67	.84	18.60
480.23	.81	19.00

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-1	50LBS (100GM) CYLINDER L/D =1.7						
	8.75	75.50	7.02	2.36	2.34	22.47	13.42
	8.79	85.30	9.45	2.37	2.37	26.83	22.32
	11.92	45.90	8.20	3.16	3.21	28.39	26.56
	11.98	39.80	8.01	3.23	3.23	25.13	25.71
	16.94	17.30	3.50	4.56	4.52	23.08	10.63
	16.98	20.80	4.65	4.58	4.56	30.22	16.99
	26.97	9.94	4.43	7.29	7.28	41.30	30.19
	27.00	10.30	4.51	7.30	7.29	43.84	31.13
	39.47	4.49	2.99	10.66	10.65	33.04	27.96
	39.73	4.15	3.08	10.72	10.72	28.98	29.46
	80.68	1.44	1.76	21.75	21.79	25.93	34.82
	80.71	1.32	1.53	21.73	21.77	21.16	28.13

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ $(PSI-MS/LB^{1/3})$	LAMBDA-P $(FT/LB^{1/3})$	LAMBDA-I $(FT/LB^{1/3})$	EQ-P (%)	EQ-I (%)
M26-2	50LBS (200GM)	CYLINDER	L/D =1.7				
	8.75	160.00	- -	2.36	- -	61.81	- -
	8.79	340.00	- -	2.38	- -	185.73	- -
	11.72	116.00	20.73	3.17	3.17	96.53	122.86
	11.98	154.00	20.68	3.24	3.24	152.05	125.91
	16.94	62.90	5.91	4.59	4.53	130.45	24.86
	16.98	66.20	10.96	4.60	4.59	140.51	69.34
	26.97	15.80	7.78	7.29	7.29	82.69	74.72
	27.00	14.10	8.51	7.29	7.30	70.19	86.67
	39.47	7.68	5.84	10.67	10.67	85.44	80.35
	39.73	7.21	5.81	10.74	10.70	78.32	80.51
	80.68	2.44	3.38	21.81	21.82	83.75	95.28
	80.71	2.12	2.86	21.78	21.80	61.74	73.70

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-3 50LBS (400GM) CYLINDER L/D =1.7							
	8.75	349.00	- -	2.37	- -	189.39	- -
	8.79	529.00	26.92	2.38	2.37	363.73	131.53
	11.72	192.00	22.33	3.17	3.16	192.46	138.94
	11.98	264.00	32.21	3.24	3.24	324.60	267.49
	16.94	94.90	7.12	4.58	4.50	223.38	33.35
	16.98	104.00	8.93	4.60	4.54	254.38	48.90
	26.97	22.80	8.75	7.28	7.26	137.61	90.01
	27.00	24.50	8.21	7.29	7.27	152.43	81.15
	39.47	7.66	7.23	10.62	10.65	84.00	112.67
	39.73	6.97	5.24	10.68	10.67	72.86	67.68
	80.68	2.44	3.39	21.71	21.74	82.69	95.41
	80.71	2.29	3.59	21.70	21.76	78.06	103.96

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-4 65 LBS (1.5 LB) CYLINDER L/D = 1.7							
	9.32	564.00	23.33	2.31	2.30	368.21	98.73
	12.00	306.00	25.22	2.98	2.97	310.24	156.99
	12.37	304.00	26.97	3.07	3.06	336.82	183.30
	14.91	118.00	17.99	3.69	3.68	155.36	117.61
	17.25	135.00	17.46	4.28	4.26	290.96	135.98
	27.17	29.60	12.10	6.72	6.71	153.24	136.87
	39.61	8.58	6.29	9.73	9.74	77.78	79.63
	42.93	8.48	5.62	10.58	10.54	97.95	74.51
	80.75	2.66	3.29	19.83	19.85	75.57	79.76
	83.92	2.69	3.55	20.65	20.67	87.25	94.89

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ ($PSI-MS/LB^{1/3}$)	LAMBDA-P ($FT/LB^{1/3}$)	LAMBDA-I ($FT/LB^{1/3}$)	FQ-P (%)	EQ-I (%)
M26-S 65 LBS (1.5 LB) CYLINDER L/D = 1.7							
	9.32	523.00	22.13	2.31	2.29	326.73	90.01
	12.00	225.00	24.97	2.97	2.97	198.13	154.33
	12.37	258.00	29.97	3.07	3.06	264.86	219.60
	14.91	172.00	17.39	3.69	3.68	261.63	111.04
	17.25	91.10	17.16	4.27	4.26	170.73	132.07
	20.17	87.00	13.71	5.00	4.98	258.26	112.00
	27.17	33.70	10.13	6.72	6.70	182.39	102.05
	30.17	18.00	6.88	7.44	7.39	105.74	62.60
	39.61	9.23	6.27	9.75	9.73	87.81	79.12
	42.93	8.23	5.97	10.57	10.56	93.16	82.17
	80.75	2.65	3.14	19.83	19.83	74.95	74.11
	83.92	2.52	3.30	20.61	20.64	75.74	84.52

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-6 65 LBS (1.5 LB) CYLINDER L/D = 1.7							
	9.32	541.00	19.17	2.31	2.29	344.67	70.20
	12.00	272.00	24.97	2.97	2.97	260.91	154.33
	12.37	299.00	25.47	3.07	3.06	328.68	166.20
	14.91	176.00	20.51	3.70	3.68	270.20	146.93
	17.25	92.40	19.49	4.27	4.27	174.01	163.58
	20.17	79.90	12.06	5.00	4.96	230.61	90.32
	27.17	26.70	9.70	6.71	6.69	133.21	95.09
	30.17	38.00	6.76	7.48	7.39	293.97	60.74
	39.61	9.87	6.39	9.76	9.74	98.03	81.70
	42.93	8.56	5.62	10.58	10.54	99.49	74.51
	80.75	2.65	3.24	19.83	19.84	74.95	77.86
	83.92	2.47	3.52	20.60	20.67	72.48	93.84

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ ($PSI\text{-}MS/LB^{1/3}$)	LAMBDA-P ($FT/LB^{1/3}$)	LAMBDA-I ($FT/LB^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-7 65 LBS (1.5 LB) CYLINDER L/D = 1.7							
	9.32	467.00	- -	2.31	- -	273.67	- -
	12.00	251.00	20.47	2.97	2.96	232.08	109.82
	12.37	309.00	- -	3.07	- -	345.03	- -
	14.91	110.00	18.21	3.68	3.68	141.16	120.11
	17.25	106.00	22.28	4.27	4.27	209.37	205.12
	20.17	72.30	12.69	4.99	4.97	201.97	98.37
	27.17	28.20	10.93	6.71	6.70	143.51	115.67
	30.17	19.10	6.76	7.44	7.39	115.13	60.74
	39.61	9.28	6.24	9.75	9.73	88.59	78.61
	42.93	8.22	6.02	10.57	10.56	92.97	83.28
	80.75	2.67	3.34	19.84	19.85	76.18	81.68
	83.92	2.50	3.57	20.61	20.67	74.43	95.94

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ $(PSI-MS/LB^{1/3})$	LAMBDA-P $(FT/LB^{1/3})$	LAMBDA-I $(FT/LB^{1/3})$	EQ-P (%)	EQ-I (%)
M26-8 39 LBS (400GM) CYLINDER L/D = 1.7							
	8.75	339.00	31.99	2.57	2.57	232.45	195.83
	8.79	362.00	33.18	2.58	2.58	260.12	209.77
	11.72	151.00	21.39	3.44	3.43	176.15	143.73
	11.98	167.00	19.82	3.52	3.51	216.73	130.03
	16.94	66.50	12.29	4.97	4.95	178.55	92.80
	16.98	45.30	14.61	4.97	4.97	108.13	124.16
	26.97	16.20	8.02	7.89	7.87	108.57	87.39
	27.00	13.70	7.07	7.88	7.86	84.78	71.21
	39.47	5.75	4.95	11.47	11.48	64.73	68.62
	39.73	6.61	5.63	11.59	11.59	85.02	85.32
	80.68	1.86	2.66	23.42	23.49	57.58	73.24
	80.71	1.78	2.57	23.39	23.49	52.02	69.73

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/$LB^{1/3}$)	LAMBDA-P (FT/$LB^{1/3}$)	LAMBDA-I (FT/$LB^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-9 39 LBS (400GM) CYLINDER L/D = 1.7							
	8.75	242.00	31.10	2.56	2.57	141.29	186.52
	8.79	369.00	24.06	2.58	2.57	267.75	120.43
	11.72	156.00	19.52	3.44	3.43	187.64	123.06
	11.98	192.00	24.71	3.52	3.52	263.72	189.15
	16.94	62.50	12.38	4.97	4.95	160.48	93.92
	16.98	37.10	12.41	4.95	4.96	82.66	94.61
	26.97	17.70	7.96	7.89	7.87	123.46	86.33
	27.00	14.70	7.10	7.89	7.86	94.36	71.70
	39.47	5.93	4.89	11.48	11.48	68.51	67.30
	39.73	6.90	5.63	11.60	11.59	91.78	85.32
	80.68	1.81	2.67	23.39	23.50	54.04	74.01
	80.71	1.72	2.67	23.35	23.51	47.98	74.05

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ $(PSI\text{-}MS/LB^{1/3})$	LAMBDA-P $(FT/LB^{1/3})$	LAMBDA-I $(FT/LB^{1/3})$	EQ-P (%)	EQ-I (%)
M26-10 8 LBS (100GM) CYLINDER L/D = 1.7							
	8.75	34.30	12.57	4.28	4.31	48.02	80.07
	8.79	32.60	7.61	4.29	4.26	45.36	34.42
	11.72	13.50	7.08	5.66	5.72	30.77	45.91
	11.98	14.80	7.59	5.82	5.87	38.34	53.22
	16.94	10.24	5.18	8.32	8.27	64.45	46.38
	16.98	11.40	4.92	8.37	8.28	77.23	42.85
	26.97	4.52	3.78	13.25	13.22	64.37	54.89
	27.00	4.29	3.51	13.25	13.20	58.23	48.94
	39.47	2.00	2.21	19.16	19.22	37.03	41.02
	39.73	2.07	2.13	19.34	19.32	41.05	39.34
	80.68	.75	1.11	39.02	39.30	32.47	41.93
	80.71	.73	1.09	38.95	39.29	30.29	41.07

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ $(PSI-MS/LB^{1/3})$	LAMBDA-P $(FT/LB^{1/3})$	LAMBDA-I $(FT/LB^{1/3})$	EQ-P (%)	EQ-I (%)
M26-11 8 LBS (200GM) CYLINDER L/D = 1.7							
	8.75	85.60	18.07	4.32	4.31	162.66	146.12
	8.79	44.40	9.84	4.25	4.22	66.24	51.81
	11.72	21.20	10.33	5.65	5.71	58.09	84.71
	11.98	24.60	8.96	5.82	5.80	78.04	68.71
	16.94	11.30	6.18	8.22	8.17	72.20	60.51
	16.98	12.90	7.09	8.29	8.25	90.32	76.58
	26.97	5.66	4.52	13.18	13.08	95.31	71.69
	27.00	5.58	4.00	13.18	13.01	93.09	58.63
	39.47	2.35	2.61	18.92	18.94	50.53	51.92
	39.73	2.37	2.88	19.08	19.18	52.73	61.79
	80.68	.82	1.36	38.18	38.83	37.59	55.89
	80.71	.81	1.27	38.14	38.69	36.37	50.37

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$1/W^{1/3}$ (PSI-MS/$LB^{1/3}$)	LAMBDA-P (FT/$LB^{1/3}$)	LAMBDA-I (FT/$LB^{1/3}$)	EW-P (%)	EW-I (%)
M26-12 8 LBS (200GM) CYLINDER L/D = 1.7							
	8.75	47.50	13.05	4.24	4.26	71.84	83.83
	8.79	44.40	11.02	4.25	4.25	66.24	63.01
	11.72	22.90	8.70	5.67	5.66	65.30	63.28
	11.98	23.70	8.45	5.82	5.79	73.87	62.18
	16.94	10.80	5.15	8.20	8.08	66.90	44.54
	16.98	11.50	6.43	8.25	8.21	74.91	65.00
	26.97	6.54	4.71	13.25	13.11	124.66	76.64
	27.00	5.66	4.73	13.19	13.12	95.65	77.46
	39.47	2.61	2.72	19.09	18.99	64.72	55.79
	39.73	2.55	3.04	19.19	19.23	62.68	67.18
	80.68	.89	1.30	38.57	38.73	47.03	52.28
	80.71	.86	1.28	38.43	38.71	42.91	51.02

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$1/W^{1/3}$ ($PSI\text{-}MS/LB^{1/3}$)	LAMBDA-P ($FT/LB^{1/3}$)	LAMBDA-I ($FT/LB^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-13,14,15 65 LBS (1.5 LBS) CYLINDER L/D = 1.7							
	85.69	2.95	2.92	21.14	21.04	113.27	72.14
	85.69	2.91	2.87	21.13	21.03	110.07	70.21
	85.69	2.49	2.77	21.06	21.01	78.73	66.40
	90.51	2.63	3.22	22.31	22.28	105.08	91.34
	90.51	2.62	3.12	22.31	22.27	104.22	86.94
	90.51	2.38	3.07	22.26	22.26	84.51	84.77
	108.30	1.95	2.78	26.67	26.68	94.45	94.83
	108.30	1.89	2.78	26.64	26.68	87.89	94.83
	108.30	1.74	2.71	26.59	26.66	72.66	90.82
	114.60	1.62	2.53	28.13	28.20	73.31	89.22
	114.60	1.57	2.46	28.10	28.19	68.10	85.16
	114.60	1.51	1.93	28.07	28.05	62.09	58.51
	120.50	1.42	2.06	29.52	29.57	62.80	69.85
	120.50	1.42	2.06	29.52	29.57	62.80	69.85
	120.50	1.32	1.94	29.44	29.53	52.64	63.52
	162.00	.99	1.77	39.72	39.85	66.05	86.67
	162.00	.98	1.75	39.71	39.84	64.42	84.81
	162.00	.86	1.70	39.49	39.83	46.56	81.12

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-B1 58 LBS (1.5 LB) 17●X17●X6●							
	8.78	311.00	12.12	2.25	2.19	137.58	30.62
	8.86	358.00	28.98	2.28	2.27	174.89	141.22
	11.77	136.00	24.35	3.01	3.02	102.42	151.33
	11.97	159.00	32.67	3.07	3.08	134.44	256.38
	16.96	73.80	15.25	4.35	4.34	137.02	111.27
	17.03	47.50	17.70	4.34	4.37	76.77	143.67
	26.99	16.90	8.41	6.88	6.88	76.45	78.30
	27.03	19.10	6.95	6.90	6.86	91.83	57.26
	39.49	6.66	6.41	10.07	10.08	56.43	86.00
	39.79	6.64	6.22	10.09	10.15	56.57	82.98
	80.69	2.13	3.65	20.43	20.62	51.45	99.08
	80.78	2.01	3.86	20.39	20.67	45.13	108.35
M26-B2N 60 LBS (1.5 LB) 7.5●X38●X6●							
	8.86	483.00	23.94	2.25	2.24	267.99	99.93
	11.77	255.00	32.82	2.99	2.99	242.58	249.11
	17.03	128.00	16.75	4.33	4.32	281.87	129.08
	27.03	27.00	9.94	6.86	6.84	144.23	101.83
	39.79	10.40	6.93	10.08	10.06	117.11	97.15
	80.78	2.62	3.56	20.37	20.41	79.31	93.80

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-B2E 60 LBS (1.5 LB) 7.5"X38"X6"							
	8.78	411.00	12.72	2.23	2.18	203.02	32.84
	11.97	150.00	20.56	3.03	3.03	119.74	114.15
	16.96	54.50	10.55	4.28	4.26	88.19	58.84
	26.99	7.75	7.21	6.58	6.78	20.33	59.76
	39.49	9.13	8.52	9.98	10.01	92.56	134.50
	80.69	3.42	3.92	20.46	20.42	138.38	109.01
M26-B3N 59.5 LBS (1.5 LB) 10.75"X53.75"X3"							
	8.86	165.00	25.64	2.23	2.25	54.10	112.98
	11.77	141.00	24.99	2.99	3.00	105.11	156.52
	17.03	48.60	9.90	4.30	4.28	77.19	53.41
	27.03	19.70	7.41	6.85	6.81	93.58	62.92
	39.79	8.29	5.53	10.06	10.04	81.32	67.61
	80.78	2.07	3.03	20.25	20.40	47.12	73.03

SUMMARY OF EXPERIMENTAL RESULTS

NORTH AND EAST BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
M26-B3E 59.5 LBS (1.5 LB) 10.75*X53.75*X3*							
	8.78	206.00	17.44	2.22	2.21	72.76	57.15
	11.97	73.30	12.08	3.00	3.00	44.47	46.05
	16.96	26.10	8.65	4.21	4.24	31.93	42.29
	26.99	12.10	9.45	6.76	6.84	44.53	93.79
	39.49	7.49	6.66	9.96	10.00	66.70	90.56
	80.69	2.80	3.44	20.44	20.43	91.97	89.13

SUMMARY OF EXPERIMENTAL RESULTS

ODD AND EVEN BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ ($PSI\text{-}MS/LB^{1/3}$)	LAMBDA-P ($FT/LB^{1/3}$)	LAMBDA-I ($FT/LB^{1/3}$)	EQ-P (%)	EQ-I (%)
(A)M26-1, 158.5= M26 AND 4= C4, SHIPPING DRUM CONF.							
	16.04	- -	37.38	- -	2.95	- -	306.22
	16.09	255.00	32.94	2.96	2.96	234.46	247.10
	26.04	75.90	13.56	4.79	4.77	189.50	103.72
	26.09	77.00	15.96	4.80	4.79	194.29	136.60
	36.04	- -	9.59	- -	6.58	- -	91.23
	36.08	29.30	9.35	6.62	6.59	144.78	87.60
	60.03	8.40	5.71	10.99	10.95	108.18	80.54
	60.08	7.60	6.92	10.98	11.00	91.45	110.06
	100.10	3.20	4.15	18.28	18.31	86.35	101.76
	100.10	3.18	4.06	18.27	18.30	85.23	98.09
	169.10	1.37	2.52	30.76	30.94	65.42	101.68
	169.20	1.36	2.54	30.77	30.96	64.40	102.93

SUMMARY OF EXPERIMENTAL RESULTS

ODD AND EVEN BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ ($PSI-MS/LB^{1/3}$)	LAMBDA-P ($FT/LB^{1/3}$)	LAMBDA-I ($FT/LB^{1/3}$)	EQ-P (%)	EQ-I (%)
(A)M26-2, 158.25= M26 AND 4= C4, SHIPPING DRUM CONF.							
	16.04	- -	34.62	- -	2.95	- -	268.41
	16.09	214.00	38.70	2.96	2.97	182.24	326.63
	26.04	60.20	15.74	4.78	4.78	139.50	133.28
	26.09	80.00	- -	4.80	- -	204.76	- -
	36.04	25.50	11.79	6.61	6.61	119.53	128.50
	36.08	25.60	- -	6.61	- -	120.58	- -
	60.03	8.02	5.90	10.98	10.96	100.15	84.96
	60.08	7.91	6.74	10.99	11.00	98.08	105.50
	100.10	3.26	4.06	18.29	18.31	89.89	98.25
	100.10	2.99	4.04	18.25	18.31	74.97	97.54
	169.10	1.35	2.58	30.76	30.96	63.24	105.33
	169.20	1.26	2.17	30.69	30.88	53.56	80.67
(A)M26-3, 158.25= M26 AND 4= C4, SHIPPING DRUM CONF.							
	16.04	231.00	40.74	2.95	2.96	201.54	355.53
	16.09	224.00	36.66	2.96	2.96	194.62	297.48
	26.04	64.80	18.32	4.78	4.79	153.83	171.96
	36.04	28.00	11.48	6.61	6.61	135.87	122.86
	36.08	30.00	- -	6.63	- -	149.71	- -
	60.03	8.16	5.84	10.99	10.96	103.21	83.67
	60.08	8.57	7.00	11.01	11.01	112.32	112.15
	100.10	3.34	4.02	18.30	18.31	94.51	96.83
	100.10	3.14	3.91	18.28	18.30	83.13	92.62
	169.10	1.31	2.49	30.72	30.94	58.79	99.44
	169.20	1.35	2.25	30.78	30.90	63.36	84.99

SUMMARY OF EXPERIMENTAL RESULTS

ODD AND EVEN BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
(E)M26-4, 951.75= M26 AND 25= C4, DROP PLUG BUGGY CONF.							
	26.04	332.00	- -	2.64	- -	243.10	- -
	26.13	407.00	27.57	2.65	2.64	334.20	157.05
	36.03	194.00	28.45	3.65	3.65	298.17	251.99
	36.15	198.00	33.13	3.66	3.66	310.03	328.52
	59.96	38.40	14.44	6.05	6.06	158.11	158.99
	100.13	7.30	7.17	10.01	10.07	64.91	102.99
	100.13	7.14	6.87	10.01	10.07	62.42	95.94
	170.13	4.16	5.12	17.14	17.15	119.11	128.51
	170.19	4.11	5.15	17.15	17.16	116.46	129.80
	320.03	1.96	2.51	32.33	32.22	170.14	106.77
	320.33	1.86	2.74	32.34	32.29	151.67	122.76
(E)M26-5, 944.25= M26 AND 25= C4, DROP PLUG BUGGY CONF.							
	26.04	- -	21.69	- -	2.63	- -	103.69
	26.13	422.00	22.41	2.66	2.64	356.03	110.28
	36.03	181.00	35.16	3.66	3.66	272.50	363.38
	36.15	220.00	- -	3.67	- -	363.07	- -
	60.13	35.40	13.15	6.08	6.08	144.20	137.08
	100.13	5.87	7.37	9.96	10.11	43.95	108.02
	100.13	5.58	6.88	9.94	10.09	39.89	96.70
	170.13	5.28	5.24	17.24	17.20	188.57	133.65
	170.19	2.74	5.06	16.99	17.20	50.47	126.75
	320.03	1.82	2.68	32.38	32.33	145.12	118.63
	320.33	1.38	2.77	32.19	32.38	76.26	125.16

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BLAST PARAMETERS OF M26E1 PROPELLANT.(U)
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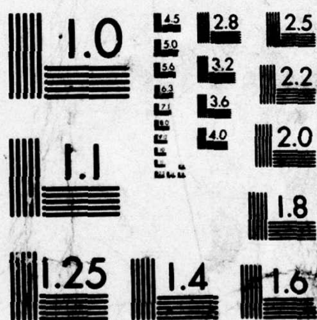
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SUMMARY OF EXPERIMENTAL RESULTS

ODD AND EVEN BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
(E)M26-6, 955# M26 AND 25# C4, DROP PLUG BUGGY CONF.							
	26.04	478.00	19.45	2.64	2.61	422.03	85.53
	26.13	390.00	17.71	2.64	2.61	311.95	73.10
	36.03	239.00	35.80	3.65	3.65	400.03	337.92
	36.15	177.00	29.12	3.66	3.66	263.60	263.00
	59.96	45.10	13.61	6.05	6.04	194.92	143.77
	60.13	33.50	12.48	6.06	6.05	132.32	125.12
	100.13	8.27	7.01	10.03	10.06	80.22	99.05
	100.13	5.13	6.53	9.86	10.04	33.43	88.27
	170.13	5.30	5.00	17.18	17.13	187.65	123.59
	170.19	4.14	4.83	17.13	17.13	117.66	116.93
	320.03	1.72	2.47	32.22	32.16	126.06	104.26
	320.33	1.83	2.69	32.29	32.24	145.62	118.79
(E)M26-70, 158# M26 AND 12.5# C4, DRYER CONF., LONG SIDE							
	36.06	122.00	17.60	3.08	3.08	94.95	89.72
	60.04	39.20	- -	5.13	- -	98.87	- -
	100.13	11.90	7.32	8.55	8.55	88.07	84.66
	170.15	5.06	5.71	14.55	14.55	104.78	120.60
	320.33	1.40	2.55	27.29	27.37	47.99	85.91
	480.23	.88	1.84	40.94	41.04	54.76	95.69

SUMMARY OF EXPERIMENTAL RESULTS

ODD AND EVEN BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
(E)M26-80, 1597.75= M26 AND 13.5= C4, DRYER CONF., LONG SIDE							
	36.06	95.70	13.78	3.07	3.07	67.81	59.10
	60.04	40.50	- -	5.12	- -	102.38	- -
	100.13	10.80	5.64	8.53	8.51	75.19	55.46
	170.15	4.35	5.01	14.49	14.50	78.28	97.68
	320.33	1.28	2.00	27.16	27.24	38.50	59.03
	480.23	.66	1.28	40.56	40.83	26.95	55.48
(E)M26-90, 1583.5= M26 AND 13.7= C4, DRYER CONF., LONG SIDE							
	36.06	120.00	14.59	3.08	3.08	92.89	65.37
	60.04	38.10	- -	5.13	- -	95.29	- -
	100.13	12.40	5.57	8.56	8.54	93.82	54.45
	170.15	3.99	5.07	14.52	14.55	66.84	99.88
	320.33	1.16	1.89	27.17	27.31	30.65	54.53
	480.23	.59	1.21	40.51	40.92	20.63	50.97
(E)M26-7E, 158= M26 AND 12.5= C4, DRYER CONF., SHORT SIDE							
	36.13	70.90	10.46	3.08	3.07	46.06	37.41
	59.98	23.00	5.44	5.11	5.08	48.08	25.40
	100.17	5.85	- -	8.49	- -	27.01	- -
	170.02	4.60	6.49	14.53	14.55	87.55	147.61
	319.90	2.16	3.16	27.36	27.36	127.45	119.29
	479.67	1.13	2.03	41.00	41.01	99.07	111.47

SUMMARY OF EXPERIMENTAL RESULTS

ODD AND EVEN BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
(E)M26-8E, 1597.75= M26 AND 13.5= C4, DRYER CONF., SHORT SIDE							
	36.13	97.70	10.08	3.08	3.06	70.13	35.03
	59.98	26.40	5.23	5.10	5.06	57.61	23.70
	100.17	6.13	4.30	8.47	8.49	29.10	35.77
	170.02	3.61	4.92	14.45	14.49	54.25	94.69
	319.90	1.55	2.22	27.21	27.23	60.02	69.28
	479.67	.85	1.53	40.75	40.84	49.74	72.32
(E)M26-9E, 1583.5= M26 AND 13.7= C4, DRYER CONF., SHORT SIDE							
	59.98	29.00	5.37	5.12	5.07	66.01	24.88
	100.17	6.25	3.77	8.49	8.49	30.40	29.12
	170.02	3.51	5.01	14.49	14.53	51.72	97.90
	319.90	1.48	2.23	27.27	27.31	54.40	69.89
	479.67	.73	1.55	40.75	40.96	34.68	73.58

SUMMARY OF EXPERIMENTAL RESULTS

ODD AND EVEN BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ (PSI-MS/LB$^{1/3}$)	LAMBDA-P (FT/LB$^{1/3}$)	LAMBDA-I (FT/LB$^{1/3}$)	EQ-P (%)	EQ-I (%)
(G)M26-10, 1910.8= M26 AND 45= C4, BLENDER CONF.							
	36.06	294.00	18.09	2.90	2.87	269.68	85.73
	60.04	93.40	- -	4.82	- -	254.39	- -
	100.13	10.70	6.44	7.94	7.95	59.90	62.25
	170.02	5.43	5.52	13.57	13.58	96.64	103.47
	170.20	5.02	6.94	13.56	13.63	83.66	149.60
	319.90	1.72	2.43	25.38	25.44	61.61	72.01
	320.33	1.73	2.48	25.42	25.48	62.72	74.42
	479.67	1.01	1.65	38.05	38.15	60.87	72.72
	480.23	.88	1.54	37.86	38.14	43.32	65.82
(G)M26-11, 1913.9= M26 AND 45= C4, BLENDER CONF.							
	36.06	- -	19.71	- -	2.88	- -	99.25
	59.98	72.90	7.96	4.81	4.73	182.02	42.70
	60.04	71.00	5.42	4.81	4.64	176.28	22.34
	100.13	13.00	6.31	7.97	7.94	81.31	60.10
	100.17	14.50	- -	7.99	- -	96.19	- -
	170.20	5.28	5.94	13.57	13.60	91.82	116.61
	319.90	2.08	2.50	25.51	25.44	95.20	75.28
	320.33	1.80	2.38	25.44	25.45	68.68	69.43
	479.67	1.05	1.64	38.08	38.12	66.86	72.05

SUMMARY OF EXPERIMENTAL RESULTS

ODD AND EVEN BLAST LINES

BASED ON INDIVIDUAL DATA POINTS

TEST TYPE	R (FT)	P (PSI)	$I/W^{1/3}$ $(PSI-MS/LB^{1/3})$	LAMBDA-P $(FT/LB^{1/3})$	LAMBDA-I $(FT/LB^{1/3})$	EQ-P (%)	EQ-I (%)
(G)M26-12, 2042.8= M26 AND 45= C4, BLENDER CONF.							
	36.06	187.00	- -	2.82	- -	131.03	- -
	60.04	60.80	5.93	4.70	4.57	134.46	25.27
	100.13	12.60	5.60	7.79	7.75	72.59	47.99
	100.17	12.50	5.64	7.80	7.75	71.78	48.58
	170.20	4.27	4.59	13.21	13.25	57.21	74.70
	319.90	1.57	2.20	24.73	24.84	46.42	59.47
	320.33	1.51	2.28	24.72	24.89	42.44	62.99
	479.67	.84	1.44	36.89	37.22	35.88	57.52
	480.23	.81	1.48	36.85	37.28	32.82	59.59

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